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ABSTRACT

The guide, intended for use by training officers and field instructors in highway maintenance management, contains five courses with a combined total of 17 units of instruction for maintenance engineers and supervisors. The curriculum incorporates management concepts and practices of State, county, and city maintenance agencies which have implemented a maintenance management system. Section 1, introduction to training in managing highway maintenance, describes design features of the training--the content, levels of instruction, and training approaches. Section 2, training unit catalog, is organized by unit and management level (one, two, and three), and contains brief descriptions and training objectives for each of the 17 model training units. Section 3, managing the training, contains guidelines as to what training officers and field instructors should do to run an effective program. Section 4, how to get the most out of training techniques, provides step-by-step guidelines for conducting lecture-workshop training, group discussions, and group discussions with a case problem. Section 5, training effectiveness, lists six training principles and five suggestions for increasing training effectiveness. (Author/JR)

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MANAGING HIGHWAY MAINTENANCE

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INSTRUCTOR'S GUIDE

For Training in
Managing Highway Maintenance

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EDUCATION & WELFARE
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FEDERAL HIGHWAY ADMINISTRATION
Offices of Research and Development
January 1973

This book is part of the series "Managing Highway Maintenance," prepared for the Implementation Division, Office of Development, Federal Highway Administration, under contract FH-11-7600. The series as a whole is described in the *Training Guide and Catalog* volume.

The contents of this book reflect the views of the contractor, Roy Jorgensen Associates, Inc. The contents do not necessarily reflect the official views or policy of the Department of Transportation.

These materials do not constitute a standard, specification, or regulation.

Implementation Division
Offices of Research and
Development

Washington, D.C.
January 1973

PREFACE

This guide is for training officers and field instructors. It contains a description and catalog of training in MANAGING HIGHWAY MAINTENANCE, and detailed guidelines for managing the training.

MANAGING HIGHWAY MAINTENANCE is a series of model training units which:

- cover the management principles applicable to highway maintenance operations;
- meet the training needs of field maintenance engineers, supervisors and foremen; and
- can readily be adapted for use by most highway maintenance organizations.

The curriculum incorporates management concepts and practices of state, county and city maintenance agencies which have implemented a maintenance management system.

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INSTRUCTOR'S GUIDE for:

TRAINING IN

MANAGING HIGHWAY MAINTENANCE

SECTION ONE: INTRODUCTION TO TRAINING IN MANAGING HIGHWAY MAINTENANCE

MANAGING HIGHWAY MAINTENANCE is comprehensive training in the decisions and tasks of maintenance field managers, management principles and the elements of systematic approaches to maintenance management.

The curriculum consists of five courses that contain 17 units of training for maintenance engineers and supervisors. This Section describes design features of the training -- the content, levels of instruction and training approaches.

COURSE CONTENT

Figure 1 shows that the training is organized and sequenced by broad subject areas:

- Management Problems. The characteristics and problems of maintenance management -- from crew scheduling and supervision to long-range planning -- and the results of work, in terms of maintenance levels and costs.

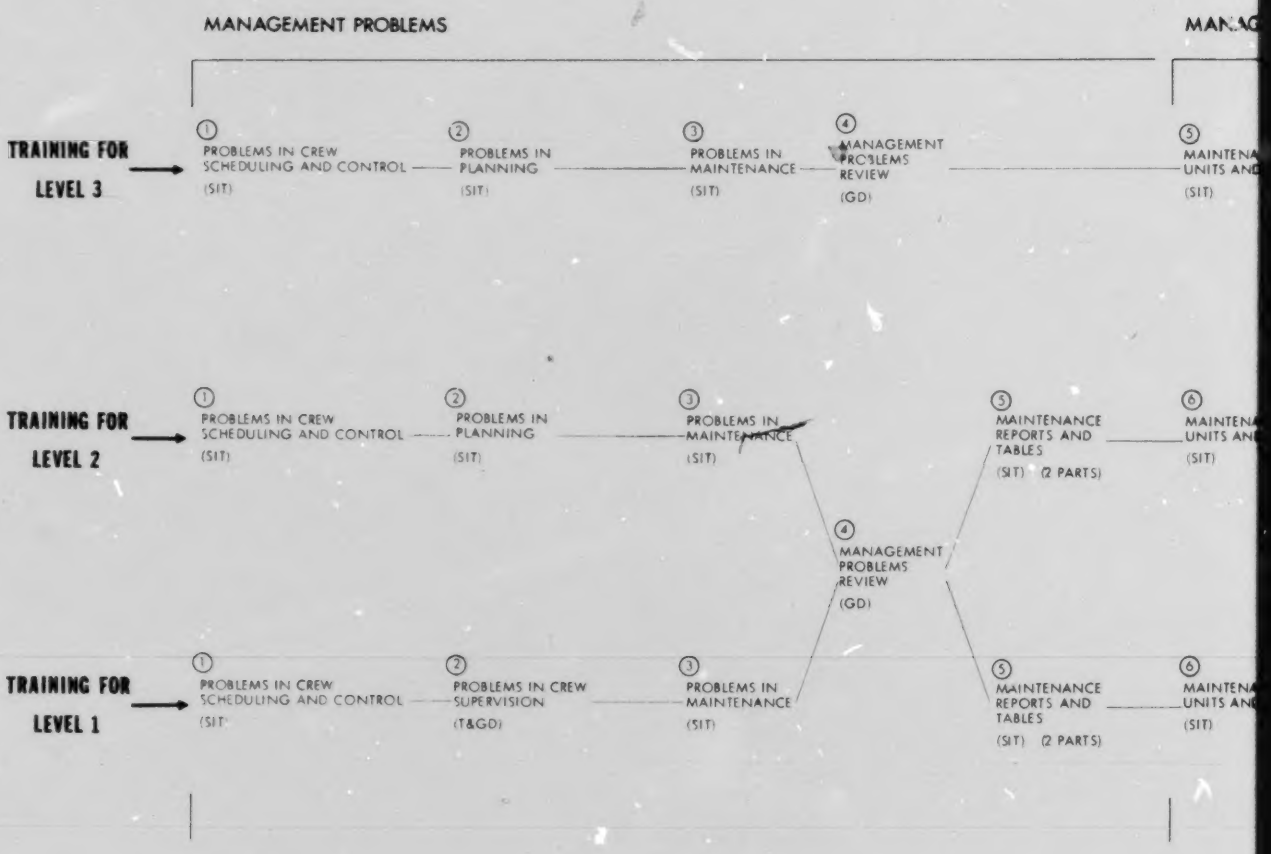
- Management By Objectives. The framework for making decisions and taking actions -- by applying principles and elements of a systematic approach to maintenance management.

- Work Planning. The techniques of effective long-range planning and crew scheduling -- and the what, how and how well of getting work done.

- Work Control. The principle of control by exception -- a step-by-step process for making sure that maintenance objectives are reached.

- Management Systems. The practical aspects of operating a system -- with the total picture, from day-to-day actions to concepts of managing highway maintenance.

The units of training in each course are designed so that one unit builds on another, according to the numbered sequence in Figure 1. Training starts with the basics of managing maintenance, then provides instruction in field managment principles and practices, and ends with an overview of what management is all about.


MANAGEMENT PROBLEMS
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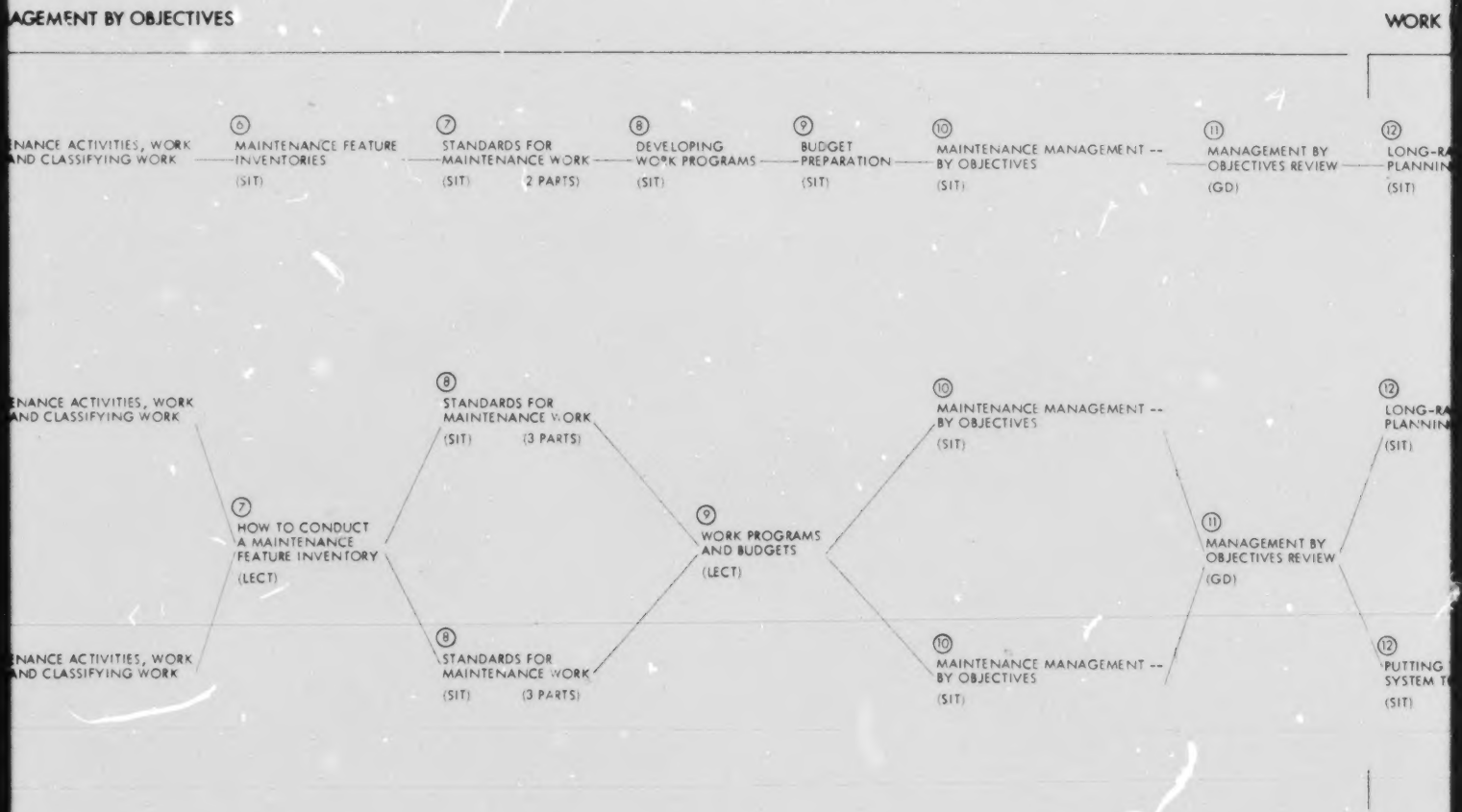
LEGEND:
- SIT : SELF-INSTRUCTIONAL TRAINING
- GD : GROUP DISCUSSION
- T&GD : TEXT AND GROUP DISCUSSION
- LECT : LECTURE WITH TRAINING AIDS

ORGANIZATION AND SEQUENCE OF TRAINING IN MANAGING HIGHWAY MAINTENANCE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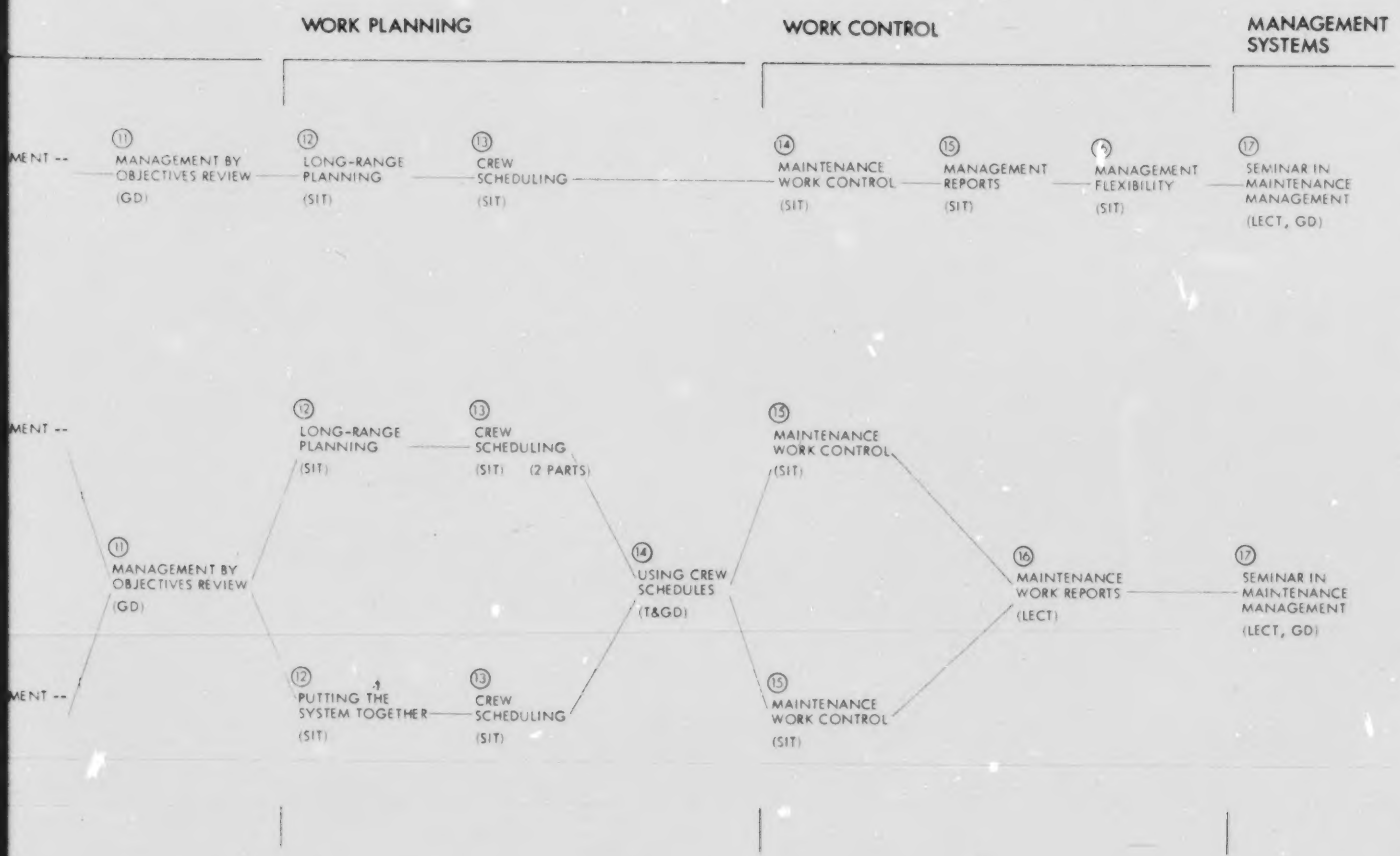
12 PUTTING SYSTEM T (SIT)

Figure 1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MENT --
12 PUTTING THE SYSTEM TOGETHER (SIT)
13 CREW SCHEDULING (SIT)
15 MAINTENANCE WORK CONTROL (SIT)

LEVELS OF INSTRUCTION

All field engineers and supervisors are exposed to managment functions and principles, but the training is written on a level-by-level basis. Each level of instruction is tailored to the decisions and tasks, and the learning capabilities of the persons being trained.

1
2
3

- Level 1. Designed for first-line managers -- foremen and crew leaders who supervise the work of one or two crews, gangs or patrols. At this level are "working" foremen whose job titles include Highway Maintenance Foreman, Sectionman, Senior Maintenance Man and Foreman I.

- Level 2. Intended for supervisors who have the resources needed to schedule and control nearly all maintenance activities. Typically, supervisors at this level are responsible for assigning work and directing the activities of three to ten foremen or crew leaders. Common job titles at this level include Maintenance Superintendent, Foreman II and Highway Maintenance Supervisor.

- Level 3. Training for the top level of maintenance field management -- where work encompasses long-range planning, coordination of special and general-purpose crews and numerous administrative functions. Included in this level are such job titles as Regional Maintenance Engineer, District Engineer, Assistant District Engineer and Special Crew Coordinator.

The levels of instruction can be adapted to meet the needs of agencies having more or less than three levels of field management -- without significantly decreasing training effectiveness. Either management or instructional levels can be combined so that all participants benefit from training.

TRAINING APPROACHES

As indicated in Figure 1, the curriculum utilizes four techniques: self-instructional materials, training in group discussions, a combination of text materials and group discussions, and the lecture-workshop method.

SELF-INSTRUCTIONAL TRAINING

Most units are designed so that a supervisor can train himself:

- The subject matter is presented in segments -- called frames.
- Each frame is of a size which permits him to understand the contents of that segment.
- The frames are sequenced to the extent that he learns each frame before going to the next one.
- The training contributes to the learning process by requiring him to participate in ways that increase his understanding of the subject matter.

GROUP DISCUSSIONS

This technique is used to exchange facts, ideas and opinions related to specific units of training in MANAGING HIGHWAY MAINTENANCE:

- It provides an opportunity for a knowledgeable instructor to reinforce learning and to gain active acceptance of training which precedes the discussion.

- It can be used to reduce apprehensions and stimulate positive approaches toward new management practices.

TEXT AND GROUP DISCUSSION TRAINING

Text materials, followed by group discussions, are oriented toward solving specific management problems. Participants study short segments of text-type training, then apply what they have learned -- by solving case problems. During the discussions, an instructor leads the group toward conclusions set forth in the text.

LECTURE-WORKSHOPS

This approach is used for units which provide training in selected management procedures. The subject matter is presented in a logical, step-by-step manner:

- The instructor has a complete script of the subject matter and model illustrations for flip chart use.

- Persons being trained are required to work through practice problems -- until the procedures have been mastered.

SECTION TWO : TRAINING UNIT CATALOG

This Section contains brief descriptions of the model training units in MANAGING HIGHWAY MAINTENANCE. Below each description are training objectives -- ones that state what a person being trained should be able to do after he completes the unit. And, where applicable, the objectives describe the level of achievement expected.

The catalog is organized by unit and management level. It includes notations about training approaches and the length of each unit. To locate the placement of the units, check Figure 1, page 3.

MANAGEMENT PROBLEMS

This is a series of training units about characteristics and problems of maintenance management. The first four units demonstrate the need for a systematic approach to managing highway maintenance.

UNIT 1
Levels 1, 2, 3

PROBLEMS IN CREW SCHEDULING AND CONTROL

Description:

This unit defines the results of work -- production, productivity, quality and costs -- and outlines difficulties in getting good results. Problems: using appropriate work procedures, matching resources to the work being done and applying work control techniques. Critical areas: lack of organization, poor communication and poor scheduling procedures.

Self-instructional

Level 1: 150 frames
Level 2: 143 frames
Level 3: 101 frames

Training Objectives:

- To identify the need for scheduling procedures and maintenance standards.
- To list accurately ways in which the results of work should be measured.
- To choose, from a number of factors, the problems and management actions which have the greatest influence on results.

UNIT 2
Level 1

PROBLEMS IN CREW SUPERVISION

Description:

Supervising is mostly communicating -- and the problems are obvious. Incomplete instructions. Misunderstandings. One-way communication. Management tools designed to help solve communication problems include scheduling procedures, written work orders and maintenance standards. Supervisory methods are identified -- including the human relations approach. Case problems -- designed for group discussion -- reinforce text materials.

Text and Group Discussion	Text and case problems (Level 1): 41 pages Instructor's Manual: 63 pages

Training Objectives:

- To identify specific problems in supervising maintenance crews.
- To describe, in specific terms, the ways in which communication problems can be solved.
- To identify the basic methods of supervision and the results of each method.
- To, with appropriate management action, put into practice the characteristics of the human relations approach to crew supervision.

UNIT 2
Levels 2, 3

PROBLEMS IN PLANNING

Description:

Limited resources, seasonal variations in maintenance work loads and authority-responsibility relationships are identified as major problems in planning -- and the solutions are very restricted in number. Training illustrates the need for guidelines concerning the what, who, how and when of seasonal work plans.

Self-instructional	Level 2: 125 frames Level 3: 101 frames

Training Objectives:

- To describe symptoms of problems in authority-responsibility relationships.
- To select, from a list of management actions, the best way to handle problems attributed to the seasonal nature of maintenance work.
- To identify the need for long-range work planning.
- To explain reasons for communicating long-range plans to subordinates.

UNIT 3
Levels 1, 2, 3

PROBLEMS IN MAINTENANCE

Description:

This unit explores reasons for variations in the kinds and amounts of work being done -- and results obtained -- in terms of levels of maintenance and costs. A main issue: why more work gets done in one area than in another -- when roadway characteristics and other factors are very similar. Management options, decisions and practices -- especially those which have the greatest impact on results -- are described. The need for a systematic approach to maintenance management is outlined.

Self-instructional

Level 1: 114 frames
Level 2: 129 frames
Level 3: 120 frames

Training Objectives:

- To explain the principal reasons for wide variations in the kinds and amounts of work being done from one area to the next.
- To isolate and describe the management practices which have the greatest impact on maintenance costs.
- To identify the need for and intent of quality and performance standards.
- To describe selected elements of a systematic approach to maintenance management.

UNIT 4
Levels 1, 2, 3

MANAGEMENT PROBLEMS REVIEW (Optional)

Description:

Highlights of the Management Problems series. Loosely structured group discussions of management problems -- designed as a sounding board for persons being trained in MANAGING HIGHWAY MAINTENANCE.

Group Discussion — Instructor's Manual: 10 pages

Training Objectives:

- To restate the management problems described in the first three units of training in MANAGING HIGHWAY MAINTENANCE.
- To state the differences between current management practices and the practices suggested by the first three units of training.
- To describe predefined conclusions about the need for a systematic approach to maintenance management.

UNIT 5
Levels 1, 2

MAINTENANCE REPORTS AND TABLES

Description:

Two parts. Part One explains how to read and interpret typical management reports. Standard terms are defined -- man-hours, accomplishment and productivity. This is a suggested prerequisite to training in Management By Objectives. Part Two shows how to read and use typical reference tables -- such as acreage, tonnage and storage capacity charts. It is a useful reference for maintenance supervisors.

Self-Instructional
with reference booklet — Levels 1, 2: 113 pages

Training Objectives:

- To identify the purpose and format of typical management reports.
- To calculate productivity values and percentages of planned performance for selected maintenance activities.
- To accurately analyze and interpret performance-related values contained in typical management reports.
- To calculate areas, volumes and weights by using common reference tables.
- To solve typical problems related to estimating materials requirements for activities such as seal coating, base repairs and culvert installation.

MANAGEMENT BY OBJECTIVES

Management by Objectives establishes a framework for making decisions -- for planning and controlling work. This is a step-by-step series of units that describe the elements of a systematic approach to managing highway maintenance. Training includes materials about work activities, maintenance standards, work programs and budgets.

UNIT 5
Level 3
and
UNIT 6
Levels 1, 2

MAINTENANCE ACTIVITIES, WORK UNITS AND CLASSIFYING WORK

Description:

This unit explains the ways in which work should be described, measured and classified. A number of practical illustrations show why and how activities are defined and measured. Instruction underscores requirements for useful work descriptions.

Self-Instructional

Level 1: 60 frames
Level 2: 84 frames
Level 3: 75 frames

Training Objectives:

- To describe selected requirements for useful definitions of maintenance work.
- To differentiate between activity descriptions which are and are not useful in planning and controlling maintenance.
- To identify those work units which adequately measure accomplishment for selected activities.

UNIT 6
Level 3

MAINTENANCE FEATURE INVENTORIES

Description:

A feature inventory is an up-to-date list of the road system features being maintained. Emphasis in this unit is on how to manage the data collection process. It includes typical instructions and forms, procedures for calculating manpower and equipment requirements, and guidelines to selecting and training inventory teams.

Self-Instructional 22 pages

Training Objectives:

- To describe the purpose and use of maintenance feature inventories.
- To list the tasks required to manage the data collection process for maintenance feature inventories.

UNIT 7
Levels 1, 2

HOW TO CONDUCT A MAINTENANCE FEATURE INVENTORY

Description:

Training for inventory teams: why an inventory is needed, how to take it and how to summarize the features. A series of practice problems ensures uniformity of results.

Lecture-Workshop Instructor's Manual with model flip charts and forms : 37 pages

Training Objectives:

- To identify the purpose of maintenance feature inventories.
- To conduct an inventory of the road system, according to predefined directions.
- To record accurately on worksheets, the features being inventoried.

UNIT 7
Level 3
and
UNIT 8
Levels 1, 2

STANDARDS FOR MAINTENANCE WORK

Description:

This is comprehensive training in maintenance standards -- with emphasis on the following:

- What standards are and why they are needed;
- Kinds of standards -- quality, quantity and performance;
- Criteria and techniques for developing each kind of standard;
- Principles of performance standards; and
- Using, interpreting, communicating and modifying standards.

As with other units, each level of instruction is tailored to the decisions and tasks, and reading capabilities of the persons being trained.

Self-Instructional with standards booklet	Level 1 (3 parts):	359 frames
	Level 2 (3 parts):	361 frames
	Level 3 (2 parts):	347 frames

Training Objectives:

- To describe the purpose of quality, quantity and performance standards -- and the results expected when these standards are used.
- To differentiate one kind of standard from another.
- To explain, in general terms, the methods used to develop the different kinds of standards.
- To demonstrate a high level of proficiency in locating the quality and performance sections of a formally prepared maintenance standard.
- To explain the meaning of terms and values found on typical standards.
- To state the principal reason for not using standard combinations of men and equipment or work procedures.
- To describe typical conditions under which deviation from performance standards are expected.

Training Objectives (continued):

- To find, in a typical maintenance standards booklet, the standard which applies to any given activity (Level 1 only).
- To identify the ways in which maintenance standards should be communicated to subordinate supervisors (Levels 2, 3).

UNIT 8
Level 3

DEVELOPING WORK PROGRAMS

Description:

Work programs: estimates of the kinds and amounts of work to be done, and the authority to perform work. Instruction centers on methods of developing work programs and calculating manpower requirements, how to use feature inventory data and standards to prepare a typical program, and how to calculate resource requirements for that program -- then level the work load on a month-to-month basis. Includes materials on using, interpreting and communicating work programs.

Self-Instructional 130 frames

Training Objectives:

- To identify, in specific terms, the purpose and content of maintenance work programs.
- To explain, in general terms, two methods of developing a work program.
- To demonstrate the way in which a work program and performance standards data can be used to calculate resource requirements for that program.
- To identify common methods of communicating work programs to subordinate supervisors.
- To describe the results of efforts to level the work load from one month to the next.

UNIT 9
Level 3

BUDGET PREPARATION

Description:

This unit describes essential steps in preparing a maintenance budget based on the work to be done -- a "performance budget." Traditional methods are compared with the process by which a price is put on work programs, and resource requirements. Typical calculations. Budget adjustments.

Self-Instructional 74 frames

Training Objectives:

- To differentiate typical budgeting procedures from the practice of developing a performance budget.
- To describe a process used to develop performance budgets.
- To perform typical budget calculations -- by applying standard (or average) unit cost data to predefined work program quantities and resource requirements.
- To identify the effects of budget adjustments on levels of maintenance.

UNIT 9
Levels 1, 2

WORK PROGRAMS AND BUDGETS

Description:

An overview of the steps in developing work programs and budgets -- the what and why of both, with typical calculations to show the logic involved. This unit is a simplified, summarized version of Units 8 and 9, Level 3.

Lecture-Workshop Instructor's Manual with model flip charts and handouts: 40 pages

Training Objectives:

- To identify the purpose of maintenance work programs.
- To describe, in general terms, a procedure for developing work programs and budgets.
- To describe the reasons for calculating resource requirements and making efforts to level the maintenance work load.

UNIT 10
Levels 1, 2, 3

MAINTENANCE MANAGEMENT -- BY OBJECTIVES

Description:

Training in management by objectives: the process of setting specific, measurable objectives, and then working toward those objectives. Traditional goals are translated into familiar, work-related goals -- and elements of management systems play a significant role. The training shows relationships among elements: work activities, feature inventories, quality, quantity and performance standards, work programs, work load leveling and budgets.

Self-Instructional

Level 1: 69 pages
Level 2: 69 pages
Level 3: 60 pages

Training Objectives:

- To describe, in specific terms, the management-by-objectives concept -- in relation to traditional maintenance objectives.
- To explain reasons for translating traditional maintenance objectives into objectives which are specific and measurable.
- To state, in general terms, the steps required to develop and use management by objectives -- on a day-to-day basis.
- To identify, in specific terms, the elements of a management system which make up the management by objectives process.

UNIT 11
Levels 1, 2, 3

MANAGEMENT BY OBJECTIVES REVIEW (Optional)

Description:

A summary of the Management by Objectives series. Loosely structured group discussions of principles, concepts and management system elements. This unit provides an opportunity for follow-up training -- with appropriate management actions.

Group Discussion Instructor's Manual: 15 pages

Training Objectives:

- To restate the management by objectives concept -- as presented in applicable units of training in MANAGING HIGHWAY MAINTENANCE.
- To identify the steps being taken to implement elements of a systematic approach to maintenance management.
- To, with appropriate management actions, put into practice, the training related to work programs and maintenance standards.

WORK PLANNING

Work Planning is a pointed series of units which identify the decisions and tasks required to plan and schedule work. Principles of work planning. Practical situations illustrate the value of using management tools and specific crew scheduling procedures.

UNIT 12
Level 1

PUTTING THE SYSTEM TOGETHER (Optional)

Description:

This unit reinforces management system concepts. Training in system parts -- and actions: using crew schedules, reporting work and controlling work. A review of what foremen and crew leaders should have learned in Management by Objectives training -- and an overview of what's to come.

Self-Instructional 67 frames

Training Objectives:

- To identify reasons for a systematic approach to maintenance management.
- To relate, in general terms, the parts of a management system and the actions needed to make the system work.

UNIT 12
Levels 2, 3

LONG-RANGE PLANNING

Description:

This is training in problems and solutions related to limited resources, seasonal variations in maintenance work loads and coordinating the efforts of several crews. Management tools: standards, work programs and charting techniques. The cost-benefit decision: maintain versus reconstruct. Materials include a step-by-step method for planning and coordinating combinations of activities. Equipment routing. Communicating seasonal work plans to subordinate supervisors.

Self-Instructional

Level 2: 133 frames
Level 3: 112 frames

Training Objectives:

- To identify techniques which can be used to minimize problems associated with fixed levels of manpower, equipment, materials and money.
- To describe the criteria by which authority and responsibility for given activities is delegated to subordinate supervisors.
- To identify significant factors in cost-benefit decisions.
- To construct charts which illustrate the sequence, scheduling and coordination required to perform typical maintenance improvement projects.
- To communicate to subordinate supervisors long-range plans which affect weekly schedules.

UNIT 13
Levels 1, 2, 3

CREW SCHEDULING

Description:

Planning ahead, setting a timetable and assigning men to do a given job at a certain time and place. Crew scheduling principles and procedures -- the why and how of effective scheduling. Training is highly work-related -- and organized by management level:

- Level 1. The basics, with summarized scheduling procedures. Orientation in how to use crew schedules.
- Level 2. Comprehensive. Maintenance standards, scheduling calendars and other management tools are put to use in six basic steps. Workbook-type problems in setting job priorities, determining resource requirements and balancing manpower and work on a day-to-day basis. Work orders.
- Level 3. Describes a framework for crew schdeuling and what field engineers have to do to make scheduling effective. Highlights of scheduling procedure and descriptions of scheduling techniques.

Self-Instructional (with standards booklet and forms for Level 2)	Level 1: 108 frames Level 2: 295 frames (2 parts) Level 3: 224 frames

Training Objectives:

- To identify, in specific terms, the basics of maintenance crew scheduling.
- To describe the results of misconceptions about crew scheduling.
- To identify the ways in which selected management tools contribute to the crew scheduling process.
- To describe, in general terms, a step-by-step procedure for scheduling maintenance work (Levels 1 and 3 only).

Training Objectives (continued):

- To explain the actions which need to be taken to use crew schedules (Level 1 only).
- To put into practice principles related to balancing manpower and the work to be done -- on a weekly and day-to-day basis (Level 2 only).
- To prepare typical crew schedules and work orders, by using work programs, scheduling calendar and maintenance standards (Level 2 only).
- To identify the steps which must be taken (by field engineers) to make crew scheduling effective (Level 3 only).

UNIT 14
Levels 1, 2

USING CREW SCHEDULES

Description:

How to get the most out of crew schedules. Training includes a summary of the basics of scheduling, but emphasis is on working the schedule -- making daily plans, giving specific instructions, checking work and adjusting the schedule. Interpreting maintenance standards. Alternate work. Twelve case problems reinforce training.

Text and Group Discussion	Text and case problems (Levels 1, 2):	57 pages
	Instructor's Manual :	81 pages

Training Objectives:

- To describe the tasks required to follow maintenance crew schedules.
- To select appropriate courses of action in instances when regularly scheduled work cannot be done.
- To demonstrate how maintenance standards should be used when performing alternate or fill-in work.

WORK CONTROL

This is a series of units about the concepts and techniques of effective work control. Training in the principle of control by exception -- the process which prevents or corrects significant exceptions to plans and standards.

UNIT 14
Level 3
and
UNIT 15
Levels 1, 2

MAINTENANCE WORK CONTROL

Description:

This unit describes the control process: finding out what is being done, comparing results with plans and standards, isolating significant exceptions, taking corrective measures, gaining active acceptance and following up control activities. Putting the lid on costs by effective work control -- with a control chart to help isolate causes of exceptional performance. Management actions. Applying the human relations approach to control efforts.

Self-Instructional

Level 1: 168 frames
Level 2: 158 frames
Level 3: 135 frames

Training Objectives:

- To describe a step-by-step process for controlling work effectively.
- To explain how costs can be controlled by using specific work procedures and staffing patterns.
- To explain, in general terms, the principle of control by exception.

Training Objectives (continued):

- To identify selected reasons for exceptional performance -- above or below standard levels of performance.
- To choose the supervisory approach which results in active acceptance of the work control process.

UNIT 15
Level 3

MANAGEMENT REPORTS

Description:

Training in analyzing and interpreting management reports. Descriptions of the kinds of data needed to control work -- with emphasis on the reporting process -- from data input to output. Cost data. Management information. Side-by-side comparisons of planning values, standards and actual results provide practice in isolating significant exceptions.

Self-Instructional 56 pages

Training Objectives:

- To analyze and interpret performance-related values contained in typical management reports.
- To describe, in general terms, the flow of data through a management reporting system.
- To compare, in general terms, the relative usefulness of cost and management data for work control purposes.
- To identify the relative significance of values shown in a typical management report.
- To perform simple calculations related to interpreting management data.

UNIT 16
Levels 1, 2

MAINTENANCE WORK REPORTS

Description:

The basics of work reporting -- why, what is needed and how it is reported -- with references to kinds of reports, data requirements, desired accuracy and information flow. Training includes extensive practice in completing daily work reports.

Lecture-Workshop — Instructor's Manual with model flip charts and forms : 40 pages

Training Objectives:

- To describe the purpose of maintenance work reports and the kinds of data required to plan and control work.
- To complete accurately a maintenance work report.

UNIT 16
Level 3

MANAGEMENT FLEXIBILITY (Optional)

Description:

Training about the need for flexibility in management systems -- and managers. A description of system elements: how and why they change. Management actions -- and reactions. Basic review.

Self-Instructional — 100 frames

Training Objectives:

- To identify the management system changes which occur as a result of efforts to keep the system operating as it should.
- To state, in general terms, the kinds of actions required to keep a management system flexible.
- To explain the effect which modifying one system element has on other elements of the same system.

MANAGEMENT SYSTEMS

One unit: a comprehensive overview of management systems. The seminar approach is used to develop the practical aspects of operating a system within the framework provided by training in MANAGING HIGHWAY MAINTENANCE.

UNIT 17
Levels 1, 2, 3

SEMINAR IN MAINTENANCE MANAGEMENT

Description:

The what, how and why of systematic approaches to highway maintenance management -- the total systems picture. System elements. Management actions. People and systems.

Six sessions:

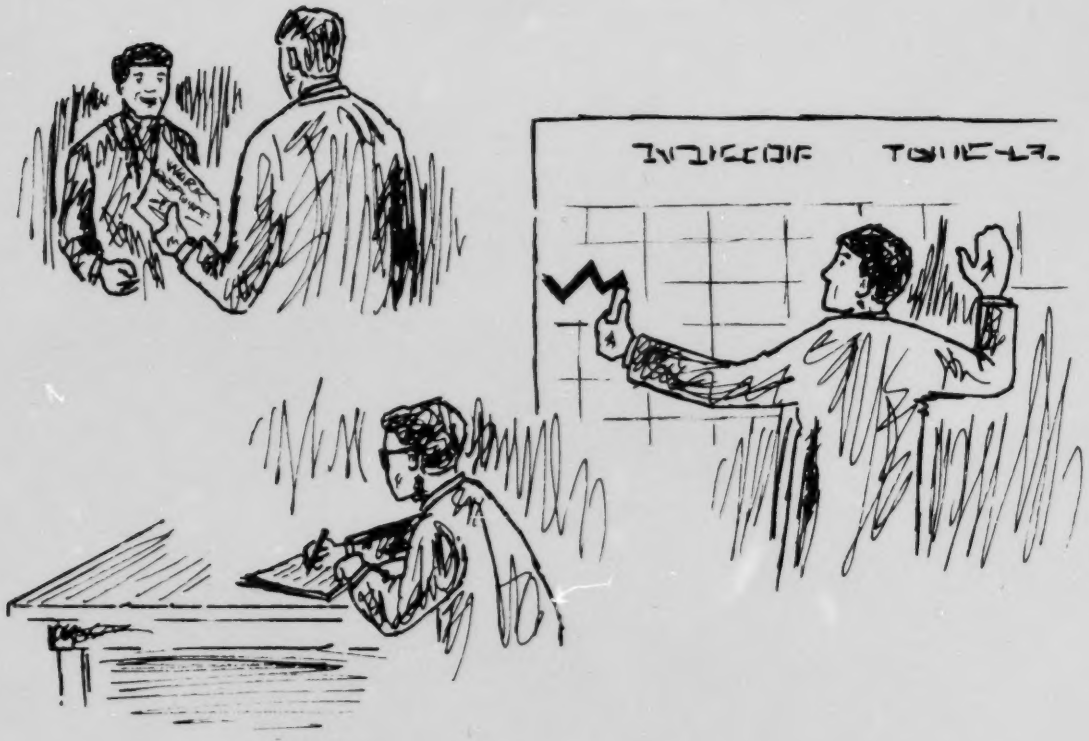
- Management and Management Systems -- seminar introduction, communication flows and management functions.
- Planning Maintenance Work -- characteristics of maintenance work, standardization and a planning framework.
- Scheduling Maintenance Work -- with emphasis on interactions among management levels.
- People and Maintenance Management Systems -- motivation, assumptions about people and the supervisor's role.
- Controlling Maintenance Performance -- oriented toward practical examples of control actions.
- Keys to Effective Operation -- focusing attention on the significant few -- and using a system: acting upon, rather than presiding over, maintenance operations.

Instructor materials for the seminar highlight important points and describe the visuals used in each session. Guidelines also are provided for modifying the Level 3 seminar for use with Levels 1 and 2.

Seminar: lecture-workshop, group discussion and visual materials.	Levels 1, 2:	6 hours
	Level 3:	10 hours
	Instructor's Manual:	101 pages

Training Objectives:

- To develop an overview of instruction received in other units of maintenance management training.
- To relate other units of training to management principles -- to provide a firm basis for implementing elements of a systematic approach to maintenance management.
- To identify the practical aspects of operating a system within the framework provided by maintenance management training.
- To describe, in general terms, the keys to effective maintenance operations.



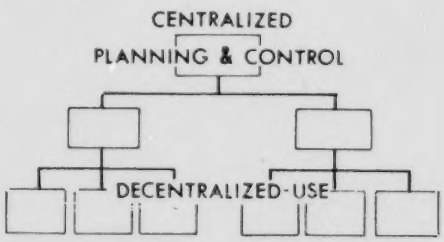
SECTION THREE: MANAGING THE TRAINING

- Who should be responsible for what training tasks?
- Who should take what training?
- How should the training be scheduled and conducted?
- How can the training be evaluated?

This section provides most of the answers to these and other questions about training in MANAGING HIGHWAY MAINTENANCE. It contains guidelines for managing the training -- the nuts and bolts of what training officers and field instructors should do to run an effective program.

TRAINING RESPONSIBILITIES

Training in MANAGING HIGHWAY MAINTENANCE represents a departure from the usual classroom approach with teachers and grading systems. Instead, the instruction is designed for decentralized use -- but with centralized planning and control.



DECENTRALIZED USE

The training can be scheduled and conducted on a field-level basis, in the same way as regular work assignments. When this is done, selected field engineers and top-notch supervisors are designated as field instructors.

Field instructors are responsible for the following tasks:

1. Help select those units of training which will meet the training needs of maintenance field managers.

2. Help select groups of supervisors who will benefit from the training.

3. Establish training schedules -- within a framework of specific completion dates for each series of units.

4. Arrange for simple training facilities.

5. Guide and assist the persons being trained.

6. Conduct those units of training involving use of the group discussion and lecture-workshop approaches.

7. Conduct and score certification tests.

8. Maintain individual records on unit completions and results.

9. Check the results of training -- in terms of the extent to which training is put into practice.

10. Evaluate and report progress and results to field managers and a central training officer.

CENTRALIZED PLANNING AND CONTROL

Day-to-day training management is guided by a top management training officer. He is responsible for several key tasks:

1. Selecting and training field instructors.

2. Working with maintenance engineers and field instructors -- to select units of training and groups of supervisors to take the training.

3. Modifying the units of training so that they contain familiar terms and values.

4. Establishing administrative procedures relative to using the materials:

   - receiving and filling requests for copies of the training;
   - setting completion times for each series of units;
   - maintaining a training records system; and
   - issuing certificates of satisfactory completion of the training.

5. Spot checking the training being conducted and meeting with field-level instructors to ensure that the Instructor's Guide and Instructor's Manuals are being used to the fullest extent.

6. Conducting the Seminar in Maintenance Management -- or making arrangements for an experienced discussion leader to do it.

7. Evaluating the total program -- in terms of the extent to which training has increased job performance.

CONSOLIDATED TRAINING MANAGEMENT

The training must be managed, and the seventeen tasks should be performed -- and some of the tasks can be combined in instances where all maintenance work is performed out of one or two offices. But regardless of whether it is centralized or decentralized, training is work -- and what you need to know about this work is described in the following pages.

WHO SHOULD TAKE WHAT TRAINING

MANAGING HIGHWAY MAINTENANCE is designed so that a step-by-step training program can be developed for individuals or groups -- on a management-level basis.

STEP-BY-STEP TRAINING

The instruction is sequenced to the point where learning that takes place in one unit is used in subsequent units. So most supervisors will want to complete the entire curriculum -- from Management Problems through the Seminar in Maintenance Management. But this does not prevent an agency from selecting only those units which satisfy training needs. In certain instances it may be desirable to deemphasize a given unit by combining it with another unit. Or the training officer and instructors may want to conduct pre-training interviews during which the need for specific subjects can be identified.

PRE-TRAINING INTERVIEWS

Who should take what training? Two approaches can be used. Approach One: All field supervisors can be required to take all or most of the units. This approach is especially useful during implementation of a new management system. Approach Two: Supervisors can be selected on an individual basis. This approach is suggested for new supervisors or for experienced ones who need training. The need for training can be determined by pre-training interviews.

Pre-training interviews are conducted to determine the extent to which supervisors possess the knowledge, skills and abilities to perform their jobs. Any lack of required knowledge, skill and ability constitutes a training need.

Interview topics should be based on an analysis of the decisions and tasks required by systematic approaches to maintenance management. For example, to identify work needs, supervisors have to make several decisions:

- What are the locations of substandard conditions?
- What work activity is needed to correct each substandard condition?
- Does the deficiency require immediate repair or can it be corrected at some later date?

The tasks related to these decisions include reviewing quality standards, inspecting roads and assigning priorities to maintenance needs.

Interview questions -- based on the decisions and tasks, and required knowledge, skills and abilities -- help make the "Who should take what" decision. Ten to fifteen key questions are needed. Listed below are some typical questions.

- What maintenance problems and management actions have the greatest influence on results?

- Frequently, there are wide variations in the kinds and amounts of work done from one area to the next. Why? How can these variations be reduced?

- What are the basic elements (or management tools) of systematic approaches to maintenance management?

- What do the following terms mean?

  Budget (or performance budget)
  Maintenance feature inventories
  Productivity
  Quality, quantity and performance standards
  Scheduling calendar
  Work orders
  Work programs
  Work units

- How are work programs developed? (Describe each step and give an example for an activity.)

- How can work program and performance standards data be used to determine resource needs?

- What kinds of data are contained in maintenance standards?

- What kinds of objectives are needed to "manage by objectives"?

The training itself answers these and other questions. So, instructors who want to conduct pre-training interviews should first know the work being done by maintenance supervisors and the objectives of each training unit.

TRAINING BY MANAGEMENT LEVEL

The three levels of instruction correspond to three broad levels of field management -- as suggested by the typical job titles on page 5. But job titles can be misleading. For example, training designed for Level 2 may or may not be appropriate for a Resident Engineer. It depends on the decisions and tasks undertaken by persons classified as a Resident Engineer. In some agencies, a Resident Engineer should be taking Level 3 training.

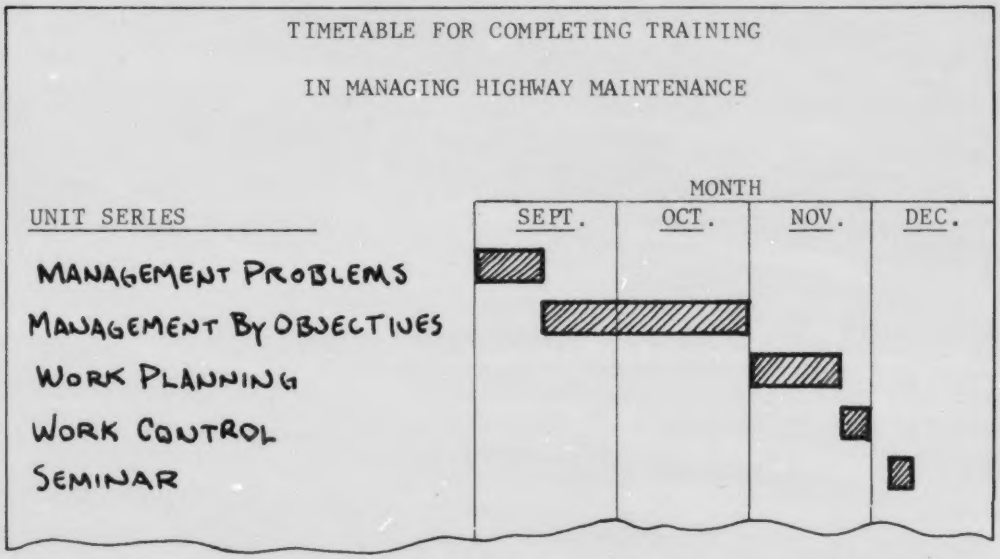
To find the best match between training levels and field management positions, the training officer and field instructors should read at least two or three units at each level. "Crew Scheduling," Unit 13, all levels, is one of the better units to use when deciding who should take what training.

SCHEDULING THE TRAINING

MANAGING HIGHWAY MAINTENANCE can be administered as part of an existing program or as the basis for supervisory training. And because the training is decentralized, it can be scheduled by field instructors -- according to a general plan developed by the training officer.

GENERAL PLAN

If all or most of the curriculum will be used, the general plan -- and instructor's schedules -- should be geared to completing the training over a period of two to six months -- or at a rate which corresponds to the implementation of a maintenance management system. The most critical part of the plan is a timetable which shows when the training is to be conducted. A typical, four-month timetable is shown below.



Notice that the timetable is laid out in the same sequence as illustrated in Figure 1, page 3. This is important. Regardless of what units will be used or who is to take the training, units in Management Problems or Management by Objectives should be scheduled before any unit in Work Planning or Work Control.

The timetable also shows that specific completion dates are set for each unit series -- such as September 15 for Management Problems training and October 31 for units in Management by Objectives. Within this timetable, instructors -- and the supervisors being trained -- can work out dates and times for taking each unit.

TRAINING SCHEDULES

As soon as a timetable has been developed, field instructors should prepare specific training schedules. Several considerations are important:

- Self-instructional materials can be administered on an individual, home-study basis. But the training will be much more effective if it's conducted individually or in small groups of three to eight persons -- during regular working hours at Department facilities.

- The training should be scheduled in blocks of two to four hours, including time for coffee breaks. All-day sessions can be effective, but only when self-instructional materials are used with other training methods.

- Self-instructional materials are self-pacing. So not everyone will be taking the same unit at the same time. Some supervisors will take a unit in one hour -- where other supervisors will need over two hours for the same unit.

- A group discussion or lecture-workshop unit should be scheduled when a group of supervisors is ready for that unit -- in terms of the sequence of training and levels of understanding.

- Because learning paces vary from one supervisor to the next, training schedules should be prepared for each supervisor -- on a weekly or bi-weekly basis.

- For planning purposes, most self-instructional units can be taken at the following rates:

  Level 1 - 60 frames or 25 pages per hour.
  Level 2 - 65 frames or 27 pages per hour.
  Level 3 - 80 frames or 34 pages per hour.

  But do not be concerned about how fast or slow a supervisor completes a unit. The important thing is that learning takes place.

- Approximate times for lecture-workshop units are given in each Instructor's Manual.

Training schedules are like maintenance work schedules. They should describe the what, who, where and when of the training -- in writing. Most instructors find that a simple memo -- to each supervisor -- works best.

TRAINING FACILITIES

Facilities for training in MANAGING HIGHWAY MAINTENANCE do not have to be elaborate. Any place with one or two tables and several chairs is satisfactory -- as long as a supervisor can concentrate on the materials. Most departments have conference rooms or field offices that are relatively quiet, well lighted and reasonably close to normal work locations. These locations are best.

In some instances, supervisors can take the training in their own offices, but most departments find that it is better to set aside a specific room for training. It could be part of a materials laboratory, lunch room or store room -- as long as it's big enough to accommodate about eight people. Larger facilities are not necessary because the training should be taken on an individual or small-group basis.

SCHEDULING CHECKLIST FOR INSTRUCTORS

Here is a summary of what instructors should do to get ready for training in MANAGING HIGHWAY MAINTENANCE.

- Study this booklet. It has useful suggestions for managing the training.
- Review with the training officer all the materials you are going to use. And make sure you know what he expects.
- Prepare a training schedule for each supervisor -- and get it to him at least a week ahead of time.
- Take care of the details. Are facilities available when you want them? Do you have enough materials for everyone -- training booklets, certification tests and answer sheets, scratch pads and pencils?

- When you schedule a group discussion or lecture-workshop check the guidelines in Section Four of this booklet, and carefully study the Instructor's Manual for the unit you have scheduled.

- Plan on changing the schedule once in a while -- because everyone doesn't read at the same speed, and because the training will be interrupted for high priority work.

One more point: If you're a field instructor and if you're having trouble getting ready for training, check with the training officer. Part of his job is to make sure you have everything you need to run an effective program.

CONDUCTING THE TRAINING

Training in MANAGING HIGHWAY MAINTENANCE is conducted by field instructors, by:

1. presenting an orientation;
2. monitoring self-instructional units; and
3. conducting group discussion and lecture-workshop training.

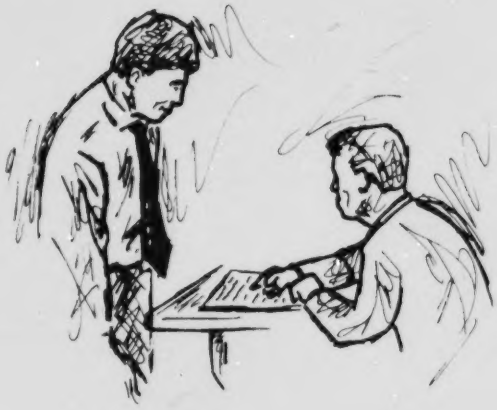
THE ORIENTATION

All supervisors being trained must receive a complete orientation -- the what, how and why of training. Several key points should be discussed during the orientation:

- MANAGING HIGHWAY MAINTENANCE is a series of training units in planning, organizing, directing and controlling maintenance. (If all or most units are being used, describe each unit series and the organization and sequence of training. Copies of Section Two of this booklet or special catalogs will help make this point.)
- The training is designed specifically for maintenance supervisors.
- The training is also designed by levels. (Explain each level and mention that the training materials have a colored band to represent the different levels: Level 1, blue; Level 2, orange; Level 3, yellow.)
- The training represents what the Department thinks is important -- and what the boss wants done.
- The training will be conducted using self-instructional materials, group discussions and lecture-workshops.

During the orientation, explain what is expected of the persons being trained. Go into details on what constitutes acceptable unit completion on certification tests and what represents acceptable performance after training. Also review administrative details, including the timetable and training schedules.

MONITORING SELF-INSTRUCTIONAL UNITS



There are two aspects to monitoring self-instructional training: the persons being trained must learn how to use the materials, and the instructor should be present to ensure that the training is treated as a regular work assignment.

How to Use the Materials

Self-instructional training is a relatively new approach to learning. Most supervisors don't know how to use the training. So, as soon as the group is ready, conduct a walk-through of ten to fifteen frames of the first unit.

During or after the walk-through explain the features of self-instructional training:

- It is designed so that a supervisor can learn the subject at his own pace. He can proceed as fast as he is able, or as slow as he needs to, in order to understand the materials.
- The subject is divided into small segments -- called frames. At the end of each frame, you are required to answer a question about the materials in that frame.
- [illegible]ning is sequenced to the extent that one frame [illegible]s on another. The information learned early in the training usually is put to use later in the same unit.
- Directions on how to read the training are given with each unit.

Self-instructional training looks like an ordinary textbook, but it's not. Explain to supervisors the fact that to complete the training they must read and follow all directions. This is important because most units require the reader to skip certain frames, re-read other frames, and write in the booklet or circle correct answers.

Self-Instructional training also might look like a test. It is not. The question and answer format is used only to make sure that the reader understands the materials before proceeding to new information. Make clear the fact that no one is going to check answers or correct any errors -- mainly because a supervisor can do the checking by himself.

Why Use Self-Instructional Training?

During or after the walk-through, also point out some of the reasons why the Department is using self-instructional training. Here's why:

- Self-instructional training is more effective than other techniques. Most supervisors are able to understand more and remember more because the training is self-pacing, sequenced and framed.
- It is flexible. The training can be taken just about any place that is quiet. And supervisors can study by themselves or in small groups -- without special teaching aids.
- It is long-lasting. Each supervisor has his personal copy of the training -- to read, mark up and use for reference or refresher training.

The Monitor's Job

Self-instructional training is effective, but if a supervisor needs help, it should be available -- from the instructor and from other supervisors. Slow readers do not need assistance unless they also are having difficulty understanding the materials.

Some indication of whether or not supervisors understand the materials can be obtained by observing the training and discussing it with each person. Discussions, in particular, help isolate those supervisors who would benefit by having explanations of difficult parts of the training. Explanations of such parts might include analogies or examples of maintenance situations similar to those presented in the training. For instance, training in the definition of work control can be viewed as "seeing to it that things get done" or "checking what is being done with what was planned" or "comparing the area's progress with overall work plans, and taking action to bring the two together." Work control also can be compared to operating a truck, where "actions are taken to make it go where you want -- by steering, accelerating and braking."

Certification tests also can isolate supervisors who typically have difficulty understanding the subject matter. Persons whose test scores are unsatisfactory on two or three units likely will have difficulty with other, subsequent units. An analysis of the number of supervisors who make mistakes on each test question will indicate the relative need for improvements in the materials and for on-the-job follow-up.

The monitor's main job is to work with supervisors who need help. But most instructors find that much of their time during training sessions can be devoted to preparing for group discussions and lecture-workshops -- and several of these units require the instructor to read the same, self-instructional units as the supervisors are taking.

CONDUCTING GROUP DISCUSSIONS AND LECTURE-WORKSHOPS

To ensure that training objectives are met, group discussion and lecture-workshop units should be conducted according to the guidelines in Section Four of this booklet. Complete scripts and step-by-step directions for conducting each unit are in the Instructor's Manuals.

When you want to know who should do what and when during a certain unit, check the Instructor's Manual for that unit.

CERTIFICATION TESTS

Certification tests indicate the extent to which training has been learned -- and there is a test for nearly every unit. The tests provide objective bases for awarding certificates of satisfactory completion of training and for evaluating training effectiveness.

TEST ADMINISTRATION

Immediately after a supervisor completes a unit, he is required to take the test for that unit.

Field instructors are responsible for conducting all tests. To conduct a test:

- explain its purpose and make sure the supervisor knows how to respond to test questions.
- prevent interruptions during the testing.
- score each test -- as directed in the Certification Test Answer Keys.

- indicate to the supervisor, after the test is scored, whether or not he successfully completed that unit.

There is no grading system associated with testing and scoring. A supervisor completes the training satisfactorily or he does not.

Certification tests are grouped by training series, but the unit test should be administered when the supervisor completes that unit -- mainly because it may be several weeks before the supervisor completes a unit series. As a general rule, certification tests should be administered within one week after the supervisor completes a unit or unit series.

There are no certification tests for the Management Problems Review (Unit 4), the Management-by-Objectives Review (Unit 11) and the Seminar in Maintenance Management (Unit 17).

TEST CRITERIA

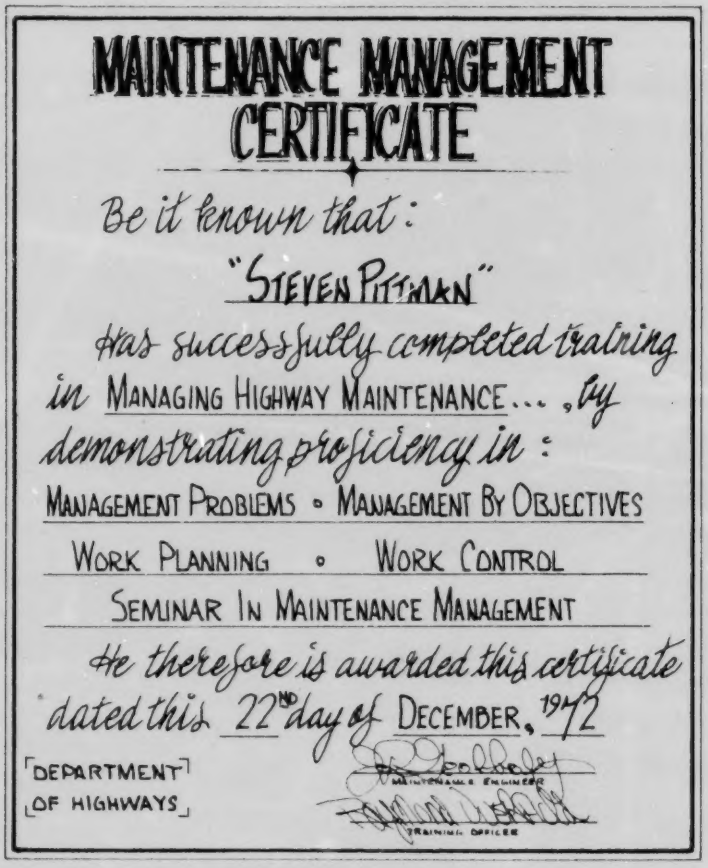
Supervisors who answer correctly seventy-five percent of the questions in a unit series are awarded certificates of satisfactory completion. Those who do not will repeat parts of the training. When repeat training is necessary, the instructor should:

- locate those parts of the training which the supervisor did not learn -- based on specific test questions. (Test questions are organized in about the same sequence as the training.)
- direct the supervisor to specific sections of the training -- and discuss each section as soon as the supervisor completes it.
- administer the same test again.

No supervisor will be required to take a test three times.

CERTIFICATES

Upon successful completion of training, supervisors should receive appropriate certificates -- such as the one below.



MAINTENANCE MANAGEMENT
CERTIFICATE

Be it known that:

"STEVEN PITTMAN"

Has successfully completed training in MANAGING HIGHWAY MAINTENANCE... by demonstrating proficiency in:

MANAGEMENT PROBLEMS • MANAGEMENT BY OBJECTIVES

WORK PLANNING • WORK CONTROL

SEMINAR IN MAINTENANCE MANAGEMENT

He therefore is awarded this certificate dated this 22ND day of DECEMBER, 1972

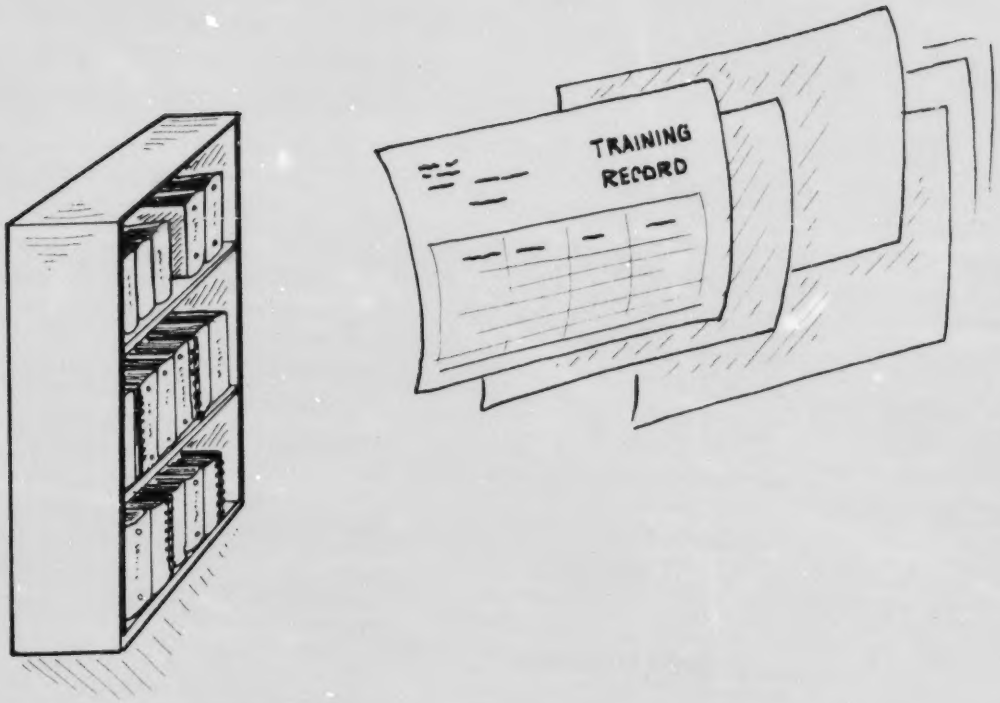
[DEPARTMENT]
[OF HIGHWAYS]

MAINTENANCE ENGINEER

TRAINING OFFICER

One certificate should be awarded for all the units a supervisor completes. If he takes only one unit or one series of units he should be given a certificate for that unit or unit series. And a copy of the certificate should be kept in the supervisor's personnel file.

Also, it is suggested that supervisors who complete the training be awarded recognition. Articles in department news bulletins and local press releases contribute significantly to a supervisor's status and to the training program in general.



TRAINING RECORDS

Training records should be maintained for three reasons:

- To keep track of a supervisor's progress in completing the training;
- To document the results of training; and
- To serve as a starting point for evaluating training effectiveness.

Usually, one simple form is all that's needed. Part of a typical record -- with appropriate entries -- is shown below.

MANAGING
HIGHWAY
MAINTENANCE

CONFIDENTIAL
TRAINING RECORD

Training Record for CHARLES COOK

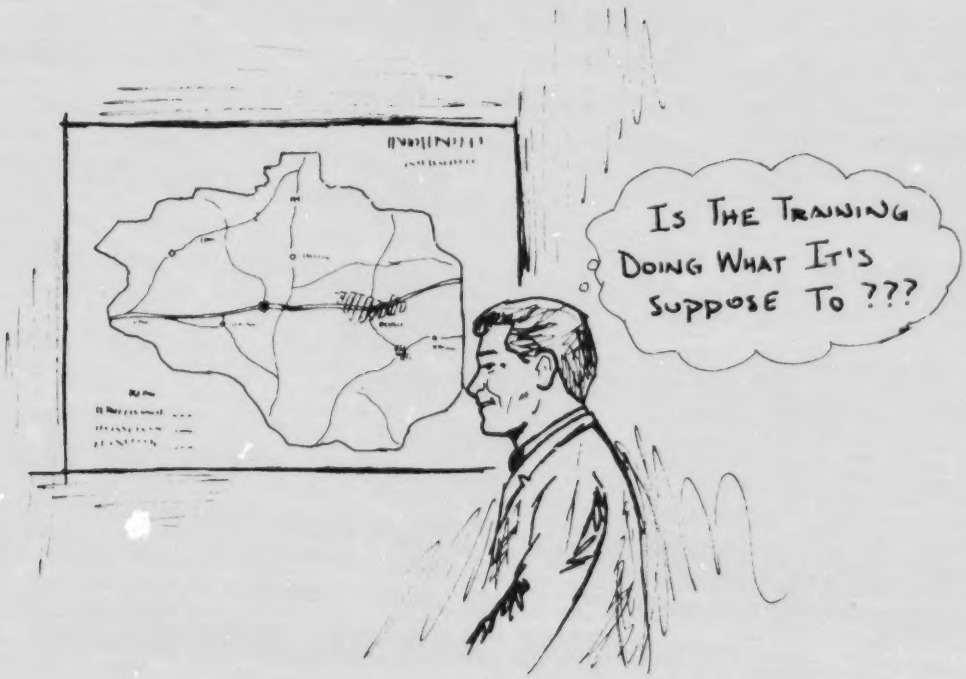
Job Title MAINTENANCE SUPERINTENDENT

Training Level 2

UNIT COMPLETED	DATE	SCORE		COMMENTS
		RAW	PCT.	
1 PROBLEMS IN CREW S&C	9/5	16	88 %	
2 PROBLEMS IN L-RP	9/12	11	85 %	
3 PROBLEMS IN MAINTENANCE	9/15	11	73/93 %	SECTION 2 TAKEN TWICE --- RE-TEST OK
4 PROBLEMS REVIEW	9/15	—	—	
5 REPORTS & TABLES (PART I)	9/21	16	100 %	
REPORTS & TABLES (PART II)	9/26	10	83 %	
6 MAINTENANCE ACTIVITIES	10/5	9	90 %	

Notice that the record is confidential. Only the training officer and field instructor need to know individual test scores.

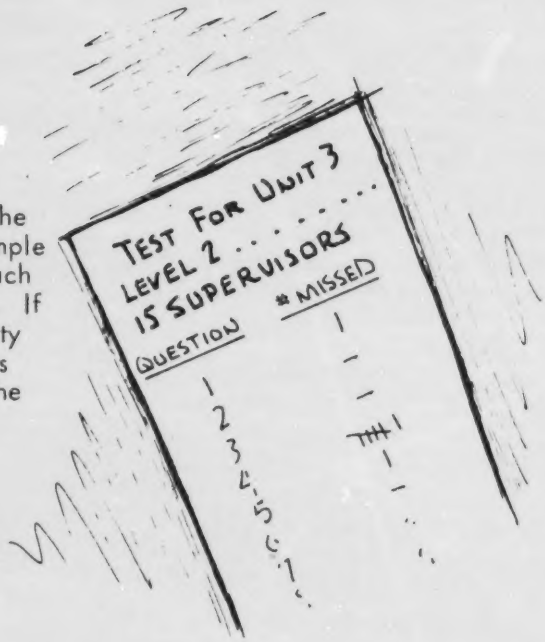
When a supervisor completes training in MANAGING HIGHWAY MAINTENANCE, it is suggested that his record and test answer sheets be forwarded to the training officer for evaluation.



EVALUATING THE TRAINING

Management training has been effective if supervisors can make decisions and perform tasks after training that they could not undertake before. So evaluations of training should be centered on results -- in terms of test scores and measurements of the extent to which performance is improved.

TEST ANALYSIS

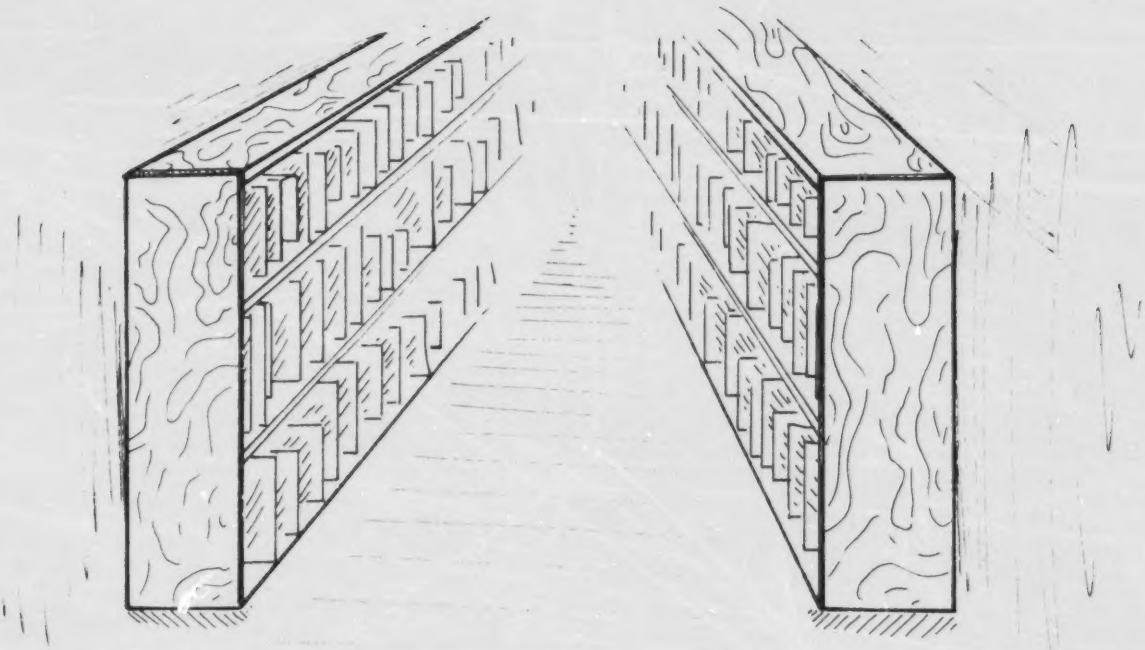


An analysis of certification tests will indicate the areas in which improvements are needed. A simple tally of the number of supervisors who missed each question will show what, if anything, is wrong. If a question is missed by more than twenty to thirty percent of those who took the test, then there is need for improvement. Either the question or the training represented by the question should be modified.

IMPROVED PERFORMANCE

The purpose of training is improved job performance. Improvements can be measured in terms of increases in production and productivity, and reduced costs. These things are relatively easy to measure. Less obvious -- and more difficult to measure -- are improvements in work procedures, workmanship and attitudes toward work.

Training officers and instructors should follow up training by making spot evaluations of the extent to which training contributes to improved job performance. Limited, periodic evaluations of training materials and results will provide valuable information for designing future materials.



REFERENCE MATERIALS

Much of the training in MANAGING HIGHWAY MAINTENANCE is based on management research -- reported in the following publications of the Highway Research Board, National Academy of Sciences -- National Research Council (2101 Constitution Avenue, Washington, D. C. 20418:

- NCHRP Report 131 — Performance Budgeting System for Highway Maintenance Management (1972)
- Special Report 100 — Maintenance Management 1968, Proceedings of a Workshop held July 22-24, 1968, Ohio State University, Columbus, Ohio (1968)
- Highway Research Record Number 241 — Maintenance Management 1967 (7 reports) (1968)
- Highway Research Record Number 298 — Maintenance Practices 1968: Performance Budgeting, Pavement Maintenance, and Winter Maintenance (5 reports) (1969)
- Highway Research Record Number 347 — Maintenance Planning and Supervision (32 reports) (1971)

The management practices described in these reports provide a useful reference point for training officers and instructors.

In addition, there are materials concerning training programs and instructional methods which can be useful in designing and developing individual programs:

- Craig, Robert L. and Bittel, Lester R. (Editors) — Training and Development Handbook, McGraw-Hill Book Co., New York (1967)
- Louisiana Highway Research — Maintenance Research: Report Six, Maintenance Training, Louisiana Department of Highways, Baton Rouge, Louisiana (1969)
- Mager, Robert F. — Preparing Instructional Objectives, Fearon Publishers, Palo Alto, California (1962)
- Markle, Susan M. — Good Frames and Bad, John Wiley and Sons, Inc. New York (1969)
- Odiorne, George S. — Training By Objectives, The MacMillan Company, New York (1970)

Many of the terms used in MANAGING HIGHWAY MAINTENANCE are based on standard definitions found in the Highway Research Board Circular 124. A reprint of this Circular begins on the next page.

HIGHWAY RESEARCH

Number 124 Subject Area: Maintenance, General April 1971

COMMITTEE ACTIVITY

Committee on Maintenance and Operations Management
Group 3 Council
Highway Research Board

Definitions for Terms Relating to Maintenance Management

Introduction

Between 1963 and 1967, there was an upsurge of interest in the management of highway maintenance. A number of research studies were carried out on almost every aspect of maintenance management. Many highway departments adopted the elements of new management systems. It soon became evident that the researchers and managers involved in these efforts did not always use a common language. Indeed, as many as five or six different terms were used to describe the same concept.

The Committee on Maintenance Management recognized the need to work toward a more uniform terminology for the area of maintenance management. In January 1968, a subcommittee, William N. Records, Chairman, was appointed to work on defining terms in common usage. After two years of work, the Committee voted to adopt and publish the list of definitions which are included in this Circular.

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* As of December 31, 1970

DEFINITIONS
FOR TERMS RELATING TO MAINTENANCE MANAGEMENT

A. MANAGEMENT

1. Activity - a specific type of work which is carried out to (a) replace an unserviceable highway physical element; (b) rehabilitate a deteriorated or unsightly element; (c) provide a service to the public or governmental agencies; or (d) support an activity which meets the criteria of (a), (b), or (c).

2. Function - a group of related activities which constitute a major component of a maintenance program (i.e., Surface Maintenance).

3. Information System - an alternate term for "Reporting System."

4. Maintenance Management System - a formal procedure which is used to plan, organize, direct, control and evaluate maintenance programs and maintenance management units.

5. Maintenance Management Unit - a component of a highway department that is responsible for carrying out specific activities in specific locations with specific resources.

6. Maintenance Organization - collectively, the management units that are responsible for carrying out the maintenance programs of a highway department.

7. Maintenance Program - a group of related functions (and their subsidiary activities) which constitute a major component of a highway department's overall program.

8. Operation - an alternate term for "Activity."

9. Performance Budgeting System - a formal procedure which is used to establish workloads, allocate resources (labor, equipment, materials, funds), schedule work and evaluate results.

10. Reporting System - a formal procedure which is used to collect, process, analyze and distribute data and information needed by the managers of a maintenance organization and its management units.

B. FACILITIES

1. Garage - an installation which (a) is used by maintenance crews for a major base of activities; (b) has substantial indoor space; and (c) may also serve as a material source or yard.

2. Material Source - a quarry, pit, plant, warehouse, stockpile or similar installation which produces or stocks a material that is either (a) transported to a work site and immediately used in activity or (b) transported to another material source and put into stock for future use.

3. Parking Area - a site which (a) is used for temporary storage of equipment units (usually overnight); (b) has no indoor space; and (c) is located on or near a roadside.

4. Shed - an installation which (a) is used by maintenance crews for a minor base of activities; (b) has minimal indoor space; and (c) may also serve as a material source or yard.

5. Shop - an installation which (a) is used for fabricating, repairing and/or servicing equipment units; (b) has substantial indoor space; and (c) may also serve as a garage, material source or yard.

6. Yard - an installation which (a) is used for storing equipment units; (b) has minimal indoor space and (c) may also serve as a material source.

C. RESOURCES

1. Attachment - a machine or mechanical device which (a) is used to carry out activities; (b) is movable; and (c) is dependent, while in use, on another machine classified as an equipment unit (i.e., a snowplow is an attachment to a truck).

2. Crew - a group of workmen and equipment units that are assigned to carry out a specific activity at a specific work site during a specific work shift. (A crew may vary in size from hour to hour, may be divided into subgroups for multi-step activities, may shift intact to a new operation or new work site, or may be disbanded at any time).

3. Equipment Unit - a machine which is (a) used to carry out an activity; (b) movable and (c) independent or semi-independent of other machines, while in use (machines which draw power from other machines through cables, belts, hoses, etc. are classified as semi-independent).

4. Fleet - a group of equipment units assigned to a specific management unit for administrative purposes.

5. Gang - a group of workmen assigned to a specific management units for administrative purposes.

6. Material - an expendable item which: (a) is used to carry out an activity and (b) must be incorporated in a highway physical element or left in place to accomplish a desired result.

7. Supply - an expendable item which: (a) is used to carry out an activity but (b) does not have to be incorporated in a highway physical element or left in place to accomplish a desired result (a supply may be incorporated or left in place by choice).

8. Tool - a machine or mechanical device which is used to carry out an activity but which does not qualify for designation as an attachment or equipment unit.

D. PERFORMANCE

1. Accomplishment - the total number of work units which are completed for a specific activity by a specific crew or crews during a specific time period (State activity, crew identification and elapsed time; i.e., crew #106 mowed 18.7 acres during the week of July 13-19).

2. Accomplishment Rate - production divided by the number of man-hours or equipment-hours expended (State activity, crew identification, elapsed time and basis for hours; i.e., Smith County crews mowed 1.17 acres per payroll man-hour during FY 1968).

3. Productivity Rate - the number of man-hours or equipment-hours expended divided by the accomplishment (State activity, crew identification, elapsed time and basis for hours; i.e., Smith County crews averaged 0.58 hours of tractor working time per acre mowed on May 28).

4. Work Load - the total number of work units which are required (or estimated to be required) for a specific activity in specific locations during a specific time period (State operation, locations, and elapsed time; i.e., premix patching on secondary routes in Smith County will amount to 1,000 tons during FY 1970).

5. Work Method - a procedure or routine which is used by a crew to carry out an activity or step of an activity.

6. Work Unit - a quantity used as a measure of work for a specific activity (State quantity and activity; i.e., tons of patching, acres of mowing).

E. STANDARDS

1. Level of Service - an alternate term for "Maintenance Standard." Use of the term in this context is discouraged because it differs from a definition given in HRB Special Report 87, "Highway Capacity Manual 1965", p. 7.

2. Maintenance Level - an alternate term for "Maintenance Standard."

3. Maintenance Standard - a formally established criterion for a specific operation which encompasses elements usually found in Quality, Quantity and Performance Standards (a Maintenance Standard will usually provide general indications about why, where, when and how an activity will be carried out as well as expected results).

4. Performance Standard - a formally established criterion for a specific activity which (a) outlines the work involved; (b) describes work methods and composition of efficient crews; and (c) lists the expected accomplishment or productivity rate.

5. Quality Standard - a formally established criterion for a specific activity which (a) describes a deficiency, condition or schedule that establishes the need for work; (b) outlines the work involved; (c) tells how to achieve good workmanship; and (d) lists expected end results.

6. Quantity Standard - a formally established criterion for a specific activity which (a) outlines the work involved and (b) lists the number of work units which are usually required to meet the quality standards for various categories of roads.

F. COSTS

1. Activity Direct Cost - the sum of labor, equipment, material and supply direct costs that can be related to a specific activity.

2. Activity Indirect Cost - the sum of labor, equipment, material and supply indirect costs that must be prorated to a specific activity.

3. Cost - a dollar value which can be attributed to a specific service, product or activity.

4. Direct Cost - a dollar value which is the sum of expenditures that can be related to a specific service, product or activity without proration.

5. Equipment Direct Cost - a dollar value which is the sum of expenditures for fuel, lubricants, supplies, parts, service labor, repair labor, insurance, depreciation, interest on investment and other items that can be related to the service provided by a specific unit or class of equipment (operating labor is not included).

6. Equipment Indirect Cost - a dollar value which is the sum of expenditures for labor fringe benefits (retirement, leave, etc.), supervision, general shop operation, procurement and other overhead items that must be prorated to the service provided by a specific unit or class of equipment.

7. Expenditure - a charge incurred by disbursing funds, transferring funds between accounts or making an entry to show the existence of a liability.

8. Indirect Cost - a dollar value which is the sum of expenditures that must be prorated to a specific service, product or activity.

9. Labor Direct Cost - a dollar value which is the sum of expenditures for wages (including overtime), subsistence, travel and other items that can be related to the service provided by a specific employee or class of employees.

10. Labor Indirect Cost - a dollar value which is the sum of expenditures for fringe benefits (retirement, leave, etc.), training, supervision, general office operation and other overhead items that must be prorated to the service provided by a specific employee or a class of employees.

11. Material Direct Cost - a dollar value which is the sum of expenditures for purchases from suppliers, and services from outside processors and/or haulers plus direct costs for highway department labor and equipment involved in processing, handling, and/or hauling a specific lot or class of material.

12. Material Indirect Cost - a dollar value which is the sum of expenditures for supervision, general office operation, procurement and other overhead items, plus indirect costs for highway department labor and equipment involved in processing, handling and/or hauling that must be prorated to a specific lot or class of material.

13. Supply Direct Cost - similar to definition for "material direct cost."

14. Supply Indirect Cost - similar to definition for "material indirect cost."

15. Total Cost - the sum of direct and indirect costs for a specific service, product or activity.

16. Unit Cost - the direct cost, indirect cost or total cost for a specific service, product or activity divided by a measure of quantity such as total work units completed.

SECTION FOUR : HOW TO GET THE MOST OUT OF TRAINING TECHNIQUES

Three approaches used in MANAGING HIGHWAY MAINTENANCE require an instructor: lecture-workshop training, group discussions and group discussions with case problems. This Section contains step-by-step guidelines for getting the most out of these techniques. The guidelines can be used with the Instructor's Manuals or for preparing and conducting separate lectures and group discussions.

LECTURE—WORKSHOP TRAINING

A lecture or "talk" is one of the most common ways of instructing employees. Most lectures are presented to inform the listener about such topics as Department policies, safety regulations and administrative procedures.

Anyone who has listened to a lecture knows that it can be boring and dull -- a waste of time. The topic may be interesting and the employee may need to know the subject, but the person doing the talking does not communicate. He fails to inform. Why? The main reasons are little or no preparation and poor instructional practices.

PREPARING A LECTURE

There are seven major steps in preparing an effective lecture.

1. Determine the characteristics of the group to be trained.
2. Determine the objectives of the training.
3. Prepare an outline of the main points of the lecture.
4. Explain each main point and organize the materials.
5. Plan for listener participation.
6. Select appropriate training aids.
7. Review the materials -- practice.

Here are the steps -- in detail:

Step One: Determine Trainee Characteristics. What does the listener know about the lecture topic? What is his job? How old is he? How much experience does he have and what are his attitudes toward the subject? All of these are trainee characteristics. They have a bearing on what is said, how it is said, and how the lecture is prepared.

The answer to the first question -- What does the listener know?" -- will supply the basis for deciding what should and should not be included in the lecture. For example, suppose there is a need to train temporary employees in "work reporting." What subtopics should be included? The purpose of work reports? The procedure for handling reports? How to complete a report? If all of this information is needed, and the listener knows nothing about reports, then all of the points will be included. Anything that is known should be excluded.

The answers to questions about trainee age, education and experience will help to determine the level of language that is used, the amount of detailed explanations required, and the amount of trainee participation needed to ensure that the material is learned.

Effective lectures are geared to the answers found in determining trainee characteristics. Usually, the differences in trainee characteristics will indicate that more than one lecture should be prepared. For example, a group of temporary employees probably should be separated into two or more lecture groups -- on the basis of experience with the Department and familiarity with its work reporting system.

Step Two: Determine Training Objectives. The objectives of any lecture should be put in terms of what the trainee will be able to do when he completes the training. Objectives for the "work reporting" training would be related to the purpose and procedures for work reporting and how to complete reports. Specific objectives would indicate that upon completion of the training, the listener will be able to:

- Identify the purpose of the Department's work reporting system; and
- Complete, in detail, Report Forms 124, 216 and 218.

Notice that the objectives in this example are related to the amount of knowledge the listener has before training. This was determined in Step One. They also describe what the listener will be able to do when he completes the training.

Are the following objectives satisfactory?

- To familiarize the listener with work reporting; or
- To teach temporary employees about work reporting; or
- To conduct work reporting training.

No. Objectives have to be geared to performance after training. None of these say anything about trainee performance.

The objectives become the basis for the lecture, and everything that is done to prepare the lecture should contribute to reaching the objectives.

Step Three: Prepare an Outline of the Main Points. As a general rule, no lecture should have more than three or four main points. The reason is simple: most people cannot learn and remember more ideas -- at one time. If this seems unlikely, take out a piece of paper and, without going back to page 68, list the seven steps in preparing an effective lecture. How many are on your list? Three -- four -- five? This is about average. If you remembered all seven steps, in the order listed, you are a real exception to the average. If all your listeners are just as exceptional, then maybe six or seven main points should be identified -- but for most people, three or four is the limit. If more points are needed, then another lecture should be prepared.

The main points in a lecture are closely tied to the training objectives. For example, the main points of the "work reporting" lecture might be:

I. The purpose of work reporting is to provide management information.

II. Three forms are used to report work.

III. Each report must be completed in detail.

Step Four: Explain Each Point. As soon as the main points have been identified, begin filling in the details -- all of them. Details for the "purpose of work reporting" would be prepared like this:

I. The purpose of work reporting is to provide management information.

A. Management information is any kind of data that will help Department supervisors plan, organize, direct and control work.

B. The most useful management information shows what was done, how much was done, what resources were used, and what it cost to do the work.

1. What: for example, premix patching

2 How much: 70 tons

3. What resources: 7 men, 3 trucks, 1 roller, 1 asphalt distributor

4. What cost: $625

C. These four things provide a basis for planning future work.

1. What has happened is compared with what should happen.

2. Corrective action is taken when needed.

D. Department supervisors "depend on you" to supply this information.

E. Work reporting is an important "part of your job."

The same kind of filling-in is done for the other main points -- until everything that needs to be included has been put on paper.

As each point is being explained, try to work in examples, comparisons and analogies. These can be used to make ideas more concrete. Examples in this booklet try to do this. Comparisons and analogies do about the same thing. For instance, a lack of "work reporting" for a manager is like a lack of roadway signs for a driver.

When all the points have been filled in, then (1) prepare a brief introduction and conclusion, and (2) ask someone -- preferably the boss -- to review the outline. The introduction and conclusion will reinforce the main points. As one speaker put it: tell them what you are going to tell them, tell them, and tell them what you have told them. An outline review will help to ensure that all of the material is covered -- in a logical, consistent manner. A good review may mean two or three rewrites, but it is worth it.

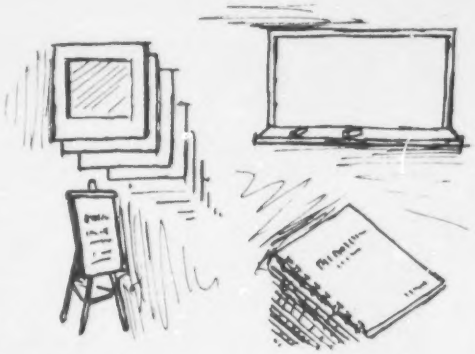
Step Five: Plan for Listener Participation. One of the quickest ways to "turn off" a group is to force it to listen, listen, and listen some more. This one-way approach to communication wrecks the possibility of meeting training objectives.

When the outline looks complete, begin developing ways to include the listener in the lecture.

Workshops are best whenever the topic relates to how to do something. The work reporting topic is a good example. One of the objectives is to show how to complete a series of work reports. So why not distribute blank reports and pencils, and have the group work several problems? Show what kind of data goes in each blank and have the group develop typical work reporting problems, or at least prepare a "practice set" and work through each form -- step by step.

If workshops are not feasible, the next best thing is to prepare a series of questions that cover the main points. The questions should be designed so that the listener has to explain the answer. "Yes" or "No" answers should be avoided. For example, ask, "What goes in blank Number 1?" -- not, "Does the employee's name go in blank Number 1?"

Step Six: Select Training Aids. Most lectures are improved when some kind of training aid is used. Chalkboards, flip charts, slides, models and practice sets help to illustrate main points. Any of these will give the listener an opportunity to look as well as listen to the lecture.



What training aids are appropriate? This depends on the topic, but more frequently it is determined by what is available. As a general rule, one or two aids -- like a flip chart and a model -- are sufficient. More than two will just confuse the listener and make presenting the lecture much more difficult. How and when to use the aids is covered in Instructor's Manuals. As far as this step is concerned, just make sure they are available.

Note: The Instructor's Manuals for MANAGING HIGHWAY MAINTENANCE contain reduced copies of model flip charts. It is suggested that they be enlarged to meet your need for training aids.

Step Seven: Review the Materials -- Practice. This is the final step. The lecture should be reviewed and studied until all of the main points and supporting materials are firmly in mind.

Two or three practice sessions or dry-runs will provide the confidence needed to present an effective lecture. The practice sessions should be conducted in the same way as you plan to present the materials. Use the outline from start to finish during the first session, and only when you need to during the second and third sessions. Whatever training aids are to be used should become an important part of the practice.

Practice may not "make perfect," but it does prevent poor performance. It smooths the bumps and rough spots.

PRESENTING A LECTURE

All of the work done to prepare a lecture pays off when you are in front of the group. The points that need to be made will be made, but the success of the lecture now depends on how well you communicate with the listener.

There are no pat solutions to effective communication, but a few suggestions may be helpful:

- Relax. Most lectures are presented to co-workers -- people who know you. Talk with them in the same way you would about any other matter.

- Use the outline. The outline, by now, is a handy reference to the points you want to make. It is only a reference, however. Do not read from it.

- Get the group involved. Use the questions prepared for this purpose. Watch for wrong answers. Right answers can be easily confirmed, but wrong ones have to be handled in ways that will not embarrass the person answering the question. If his answer is partly correct, say so, and then build on it to make a completely correct answer.

- Use the training aids. Chalkboards and flip charts are effective -- when properly used. To get the most out of them:

  Print or write in large, clear letters.

  Develop the materials step by step, rather than all at once.

  Erase or cover the materials as soon as they have served their purpose.

  Talk with the group, not to the chalkboard or flip chart.

- BIG LETTERS

- TALK TO THE GROUP

- If 35 mm. slides, models or practice sets are used:

  Make sure that everyone can see the materials on the screen or model. Rearrange the seating if needed.

  Display the slides or models just long enough to get the point across.

  Distribute practice sets when they will be used, not before.

- USE TRAINING AIDS CAREFULLY

- Keep it short. Somewhere around 20 to 25 minutes is the ideal length for a lecture. No lecture should run over 30 minutes, unless the listeners are actively participating in the training. Participation is the key. For example, a 20-minute lecture on work reporting can be followed by a 40-minute workshop or actual practice in completing the reports.

SUMMARY

Presenting a lecture is not easy. The topic must be covered in a logical and complete manner, and it has to be presented in ways that will attract and retain the listeners' attention.

The steps needed to prepare an effective lecture are:

1. Determine the characteristics of the group to be trained.
2. Determine the objective of the training.
3. Prepare an outline of the main points of the lecture.
4. Explain each main point and organize the materials.
5. Plan for listener participation.
6. Select appropriate training aids.
7. Review the materials -- practice.

When it comes to communicating the materials, remember:

1. Relax,
2. Use the outline,
3. Get the group involved,
4. Use the training aids, and
5. Keep it short.

GROUP DISCUSSIONS

Lectures are conducted to inform the listener. Group discussions are conducted to exchange facts, ideas and opinions concerning a certain topic. Group discussions are appropriate when (1) all of the participants have a pretty good knowledge of the subject matter and (2) the training objectives are related to the solving of problems.

Common maintenance subjects and typical training objectives would include those shown on the next page.

Subject	Typical Objectives
Problems in Scheduling Work	To identify scheduling problems and to develop solutions to the problems
Communicating with Subordinates	To identify the best ways of directing and controlling work
Work Quality in Maintenance	To determine the steps which can be taken to improve maintenance procedures
Reviewing Performance Reports	To evaluate crew performance and to identify the steps to be taken to improve production.

Normally, a discussion group consists of three to eight persons, one of whom is responsible for planning and conducting the discussion. If you are that one person, don't stop here -- read on.

PLANNING A GROUP DISCUSSION

Most of the work done to plan a group discussion is similar to the steps used to prepare a lecture. The main difference is the kind of planning needed to direct and control the discussion.

Planning the discussion includes these steps:

1. Determine the characteristics of the group to be trained.
2. Determine the objectives of the training.
3. Prepare an outline of the discussion.
4. Develop supporting materials.
5. Plan for participant reactions.
6. Take care of administrative details.
7. Review all materials -- practice.

The details of each step are as follows:

Step One: Determine Trainee Characteristics. The purpose of this step, as with preparing for a lecture, is to determine what should be included in the training and how it should be presented.

What should be included? The answer when preparing a lecture is: include only the topics in which the listeners have no knowledge. The answer when planning a group discussion is: include only the topics in which the participants are knowledgeable. The participants have to know something about the subject. Otherwise, there will be little or no discussion, and the training will fail.

How should the topics be presented? As with a lecture -- age, education and experience of the participants are things to consider. When analyzed, these characteristics should give some clues as to the best ways to present the materials.

Step Two: Determine Training Objectives. As with a lecture, objectives should be put in terms of what the trainee will be able to do when he completes the training. What conclusions should the participants reach when they have completed the discussion? What actions should they take after the training? These are the kinds of questions which have to be answered -- on paper, in writing. Without training objectives, little or nothing will be accomplished.

Step Three: Prepare an Outline. This step is identical to the work done to prepare a lecture outline. Three or four main points should be put on paper and checked against the training objectives. In effect, the objectives state what will be accomplished. The outline indicates what will have to be said in order to reach the objectives.

Step Four: Develop Supporting Materials. Supporting materials include anything that is needed to ensure that training objectives are met. Most of the development work centers on collecting data and preparing "handout" materials.

Collect data that will support the main points. For example, if a main point of the discussion is, "We are spending too much money on premix patching," then collect the facts on patching costs. If another point concerns the ways to reduce patching costs, then do enough research to be able to list some of the ways. These kinds of data will (1) provide the facts and ideas the group will need during its discussion and (2) help to clarify your own thinking on the subject.

Handouts are useful training aids. They supply -- in writing -- most of the details about the points to be discussed. Typical handouts are copies of such things as the discussion outline, summaries of the data you have collected and checklists of the problems to be discussed, along with some likely solutions.

Just about any other common training aid can be adapted to suit a group discussion. Chalkboards and flip charts are used to summarize the ideas brought out during the discussion or to list pertinent facts. View-graphs and 35 mm. slides can be useful for explaining some of the main points or for illustrating topic data.

Step Five: Plan for Participant Reactions. By the time the first four steps have been completed, the discussion leader should know what will be covered and how and when the main points will be presented, but not much thought will have been given to how the participants will participate -- how they will react.

A group discussion cannot be successful unless all of the participants contribute -- by expressing opinions, asking or answering questions and, in general, entering into the

discussion. One of the most effective ways of stimulating discussions is to ask questions. Many of the questions can be prepared before the discussion. For example, if a main point concerns work procedures for patching shoulders, any of the following kinds of questions might be used:

- Leading (question suggests the answer)

  "Should loose shoulder materials be rolled or should traffic be allowed to do the job of compacting?"

- Informational

  "What has been your experience with shoulder rutting?"

- Problem-Oriented

  "Is there some way we can prevent the rutting?"

  "How can our present procedures be changed so that rutting is prevented?"

- Factual

  "How much did it cost to patch shoulders in your area?"

- Discussion Summary

  "What are the main points (or decisions or conclusions) made so far?"

Notice that these kinds of questions avoid a "Yes" or "No" response. All of them have to be answered by some kind of statement or explanation from the participants.

When preparing discussion questions, some thought should be given to the way each question will be answered. Will the question lead into areas that are unrelated to the topic? Will it confuse the issues? Is there an acceptable answer? Will the participants' understanding of the subject lead to deadends? In short, will the give-and-take help to accomplish the training objectives set in the first place?

Effective questions are difficult to formulate on the spot, so prepare several before the discussion takes place.

Step Six: Take Care of Administrative Details. Several administrative matters need to be taken care of before the discussion. A checklist of things to do would include the following questions:

Physical Facilities

Is an adequate meeting room available?

Are sufficient tables and chairs on hand?

Are chalkboards and other training aids ready?

Are pencils, paper, chalk and erasers on hand?

Is coffee available?

Group Notifications

Have dates, places and times been announced?

Have pre-discussion materials been distributed to participants?

Do participants know what is expected?

Are transportation arrangements needed?

The second category of things to check -- the group notifications -- usually is the more difficult of the two. At least a week or more before the meeting, the participants should be told the purpose of the discussion and the topics to be discussed. For some meetings, participants should be required to prepare some of the discussion materials, by collecting data on specific topics, reading and studying handouts prepared for the discussion or developing questions related to discussion topics.

Step Seven: Review the Materials -- Practice. As with lecture preparations, the final step is to review and study all of the main points and supporting materials. By this time, the discussion leader should "have it all together." He should know exactly what needs to be done and how to go about doing it -- to include the answers to such questions as:

- What are the participants expected to learn?
- How can the participants be encouraged to enter into the discussion?
- How can the discussion be controlled so that training objectives are met?

LEADING A GROUP DISCUSSION

The effectiveness of a group discussion depends on how well the leader is able to do his job. To get an idea of the work involved, compare some of the differences between a bull session and a group discussion:

	THE TYPICAL	
	BULL SESSION	GROUP DISCUSSION
Purpose:	Entertainment	Management training
Topics:	Anything from sports to money	Restricted to maintenance management
Number of Participants	Any number	Generally 3 to 8
Knowledge Required by Leader:	Little, if any	Detailed knowledge of the topics
Skill Required by Leader:	None required	To direct group thinking and to shape opinions
Ability Required by Leader:	To out-talk others	To listen and to summarize conclusions
Leader's Role:	To convince others	To encourage discussion

The discussion leader's tasks range from limiting the discussion or keeping on the beam, to directing group thinking and summarizing what has been said.

Key Tasks. Any discussion leader has several tasks to do during the discussion:

- Open the discussion by reminding the group of what is to be accomplished. This should be a review of the purposes of the meeting and the topics to be discussed -- as shown in pre-discussion materials prepared during Step Six, above.

- Get the group talking -- early in the meeting. This can be done by reviewing the pre-discussion materials or asking questions about the participants' first reactions to the subject matter. The important thing is to encourage participation. Make it clear that you are not going to do most of the talking.

- Keep the discussion aimed in the right direction -- toward the main points and in line with the training objectives. If the participants seem to be getting off the beam, tell them so. Remind them of the main points.

- Encourage each participant to develop or explain his point of view, but do not allow any one person to monopolize the discussion. This is a difficult task beacuse the leader must try to determine when and how to move the "spotlight" from one person to another -- and there are no pat answers. One way is to move off the issue by tying in what was just said to a new point in the discussion outline.

- Summarize what has been said. Short, frequent summaries during the discussion and at the conclusion tend to give the participants a sense of accomplishment. The final summary should reemphasize the important points, ideas and decisions made by the group. The most effective summaries are those which the group develops -- with guidance from the group leader.

SUMMARY

The best group discussions are those in which (1) all participants know something about the subject matter and (2) the training objectives are related to solving problems. The preparations for a group discussion involve a step-by-step approach that includes the development of an outline and supporting points, and considerable thought concerning how the participants can be encouraged to enter into the discussion.

During the discussion, it is up to the leader to:

1. Get the group talking,
2. Keep the discussion aimed in the right direction,
3. Encourage development of main points,
4. Keep the discussion moving from one person and point -- to another, and
5. Summarize what has been said.

GROUP DISCUSSIONS WITH CASE PROBLEMS

Management training frequently uses "case problems" as a basis for group discussions. A case problem is a brief, written story that describes a series of actual events. The events are designed to highlight one or more management problems -- such as a supervisor having trouble scheduling maintenance work or a foreman giving incomplete instructions to his crew.

PURPOSE OF CASE PROBLEMS

The overall purpose of a case problem is to increase a supervisor's ability to analyze and resolve common management problems. The person being trained by this method reads the story, identifies the main problems and recommends solutions. This he does by himself. He then is brought together with other supervisors to analyze the problems and exchange ideas concerning case solutions.

Specific objectives of group discussions with case problems might include:

- Identifying the basic methods of supervision and the results of each method;
- Adopting a new maintenance work scheduling prodcedure; and
- Putting into practice, characteristics of an effective approach to supervision.

Objectives such as these have been specified for each unit of training in MANAGING HIGHWAY MAINTENANCE.

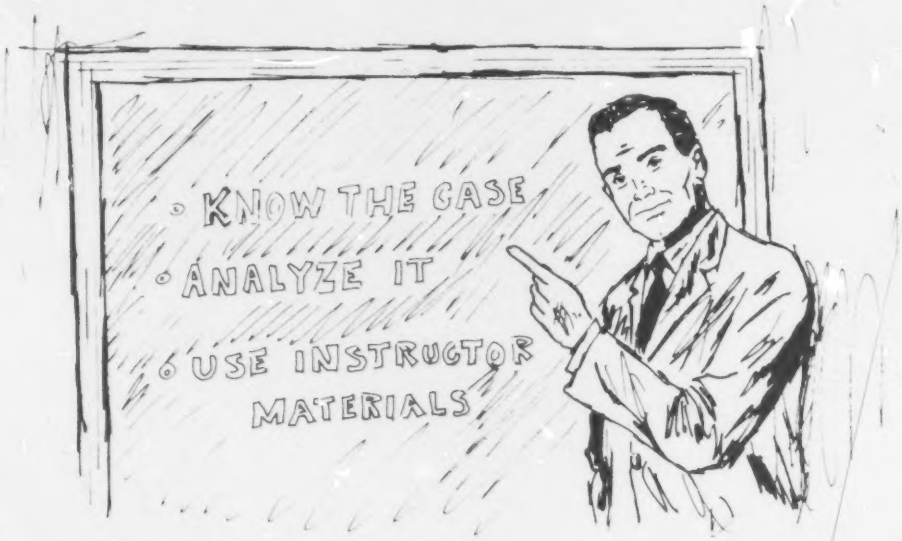
PREPARING FOR GROUP DISCUSSIONS WITH CASE PROBLEMS

When case problems are used in a group discussion, the group leader must make all of the preparations he would make for a regular discussion. In addition, he should:

1. Study the case problems;
2. Read the instructor materials prepared for the unit; and
3. Assign to the participants specific cases for study.

Studying Case Problems. Case problems are short, critical excerpts from real life situations -- with the facts needed to solve the problems. Because the facts are based on real life situations, the group leader must "read himself into the case," separate facts from opinions and feelings, and try to visualize how group participants will handle the case. When the "read-in" has been done -- when the group

leader knows the case -- he is ready to analyze it in terms of (1) the management problem it presents, and (2) the solutions which will resolve each problem. This is studying a case.



Instructor Materials. Case problems in MANAGING HIGHWAY MAINTENANCE include instructor materials. These materials consist of:

- All text materials available to the participants;
- The case problem, itself, along with questions for discussion purposes;
- Answers for each of the discussion questions;
- An identification of the main problem or problems in the case; and
- Recommended solutions for solving the case.

Instructor materials are designed to help the group leader reach specific training objectives. So the only time he should deviate from recommended solutions is when they clearly do not apply -- when the backgrounds of the participants or local administrative conditions would invalidate the solutions.

Case Assignments. The final step in preparing for a group discussion using case problems is to assign cases to the participants. It is important that they know what they are expected to do before the scheduled discussion. At least one week in advance, each participant should be instructed to:

- Read the text materials preceding the cases;
- Study the cases in detail;
- Determine the main problem or problems -- in writing; and
- Identify possible solutions -- in writing.

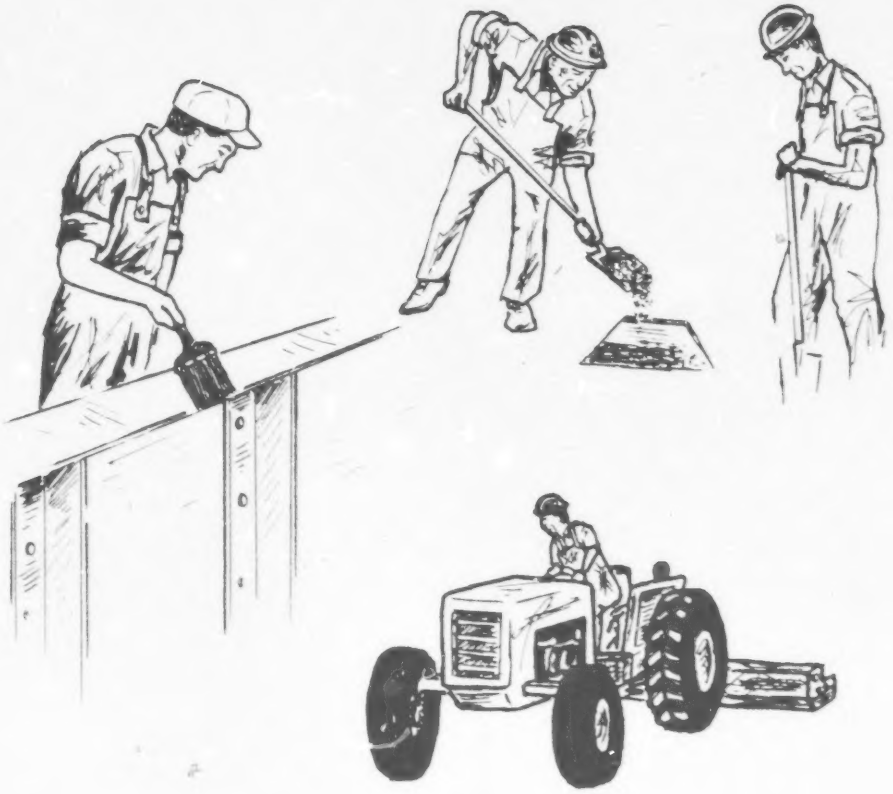
The requirement that problems and solutions be written helps to ensure that each participant will be prepared to contribute his ideas toward solving the cases.

CONDUCTING GROUP DISCUSSIONS WITH CASE PROBLEMS

The key tasks of the group discussion leader are similar to the role he plays when no case problems are used. He must:

- Encourage participation -- early in the discussion;
- Keep the discussion aimed toward the main points -- the facts, problems and solutions in the cases;
- Direct group thinking in ways that will accomplish training objectives; and
- Summarize what has been said.

The exceptional feature of a case problem discussion is that the group's attention must be focused on concrete issues -- especially those which lead to recommended solutions. Because only the group leader has these solutions, it is up to him to guide the participants toward isolating the issues and resolving the problems.



SECTION FIVE : TRAINING EFFECTIVENESS

Management training has been effective if supervisors can make decisions and perform tasks after training that they could not undertake before. Research done in conjunction with MANAGING HIGHWAY MAINTENANCE indicates that several principles and guidelines apply to training maintenance supervisors.

TRAINING PRINCIPLES

One: Management training materials must communicate to supervisors the ways in which work is to be done.

The work of highway maintenance supervisors includes decisions and tasks related to all of the basic management processes: planning, organizing, directing and controlling. Training materials must provide the knowledge, skills and abilities needed to undertake these processes -- according to department objectives.

Two: The subject matter for training should be limited to that which supervisors need in order to perform their jobs.

The use of unnecessary materials impairs the effectiveness of any training program by detracting from subject matter which is both job-related and needed. To avoid using unnecessary materials, it is necessary to (1) describe the elements of the work to be done and (2) determine the extent to which employees possess the knowledge, skills and abilities needed to do that work.

Three: The subject matter for training must have the approval and support of top management.

Much of the long-term efrectiveness of training depends on the extent to which top management officials encourage their supervisors to apply the training to everyday decisions and tasks. The learning that takes place during training is of little value unless it is reinforced by on-the-job practice. The necessary practice will occur when the "boss" indicates that the training reflects the ways in which the work is to be done.

Four: Training materials must be tailored to accommodate the management practices of the organization.

Most management training materials are prepared for wide distribution. For these materials to be effective, they must be modified to reflect the policies and procedures that are unique to a given department. This is particularly true of training in manc .ment principles. Such training should illustrate the specific ways in which the principles apply to the department's own practices.

Five: Training materials must be tailored to meet the learning characteristics of the persons to be trained.

The years of age, education and experience of employees and the capabilities of the employees to benefit from training are among the characteristics that have a bearing on the preparation or modification of training materials. These characteristics should dictate the specifications for training, to include the length of the materials and the levels of language used.

The variations in learning characteristics found in most highway maintenance agencies indicate that topics which are applicable to large groups of supervisors should be modified to suit the capabilities of two or more sub-groups. For example, one unit of training in work planning might be presented as three separate units for training relatively slow learners.

Six: The effectiveness of training materials must be determined before they are used.

The purpose of training is improved job performance. Thus, an evaluation of training effectiveness should begin with trial-run measurements of gains in knowledge, skills and abilities that enable supervisors to improve performance. Emphasis should be placed on measuring the knowledge, skills and abilities of supervisors, both before and after training, in trial-run situations, and identifying the gains which can be attributed to given combinations of training methods and media. Objective tests and observations of performance should be used to isolate these elements.

Trial-run testing with randomly selected individuals will point out the areas in which improvements are needed. Follow-up testing and limited, periodic evaluations of training materials will provide valuable information for designing future materials.

INCREASING TRAINING EFFECTIVENESS

Several steps can be taken to increase the effectiveness of management training materials.

One: The capabilities of supervisors to benefit from training can be increased by using appropriate instructional methods.

The technology of management training is such that almost any technique can be adapted to suit the needs of highway maintenance agencies. The real task, then, is to isolate the techniques or combinations of techniques, which will contribute

to the supervisors' understanding of the subject matter. Results being obtained with self-instructional materials suggest that this method is among the most effective. Self-instructional materials can be designed to incorporate desirable features of other techniques. The give-and-take of a group discussion and the analytical reasoning required to solve case problems can be built into the training. Where specific management procedures are to be learned, a programmed workshop, with actual or simulated job performance, has the potential for being very effective.

Two: The effectiveness of training materials can be increased by using instructional media that are appropriate to the subject matter and the persons being trained.

A wide variety of visual aids and equipment are available. They range from simple diagrams, 35 mm. slides and models, to sophisticated video-tape recordings and films. In most instances, more than one medium can be used to attract and retain the attention of persons being trained. For example, a tape-recorded script synchronized with 35 mm. slides, followed by actual practice, might be appropriate to training in work methods analysis or maintenance planning. Illustrated workbooks and flip charts might be useful in depicting the decisions and tasks of maintenance managers.

Three: The effectiveness of a total training program can be increased by administering training in ways that are compatible with the conditions under which work is being done.

Highway maintenance supervisors typically are called upon to react to a wide variety of frequently changing conditions. Their jobs require them to be "on top" of the work being done. A training program designed for them should minimize any inconvenience associated with training, and at the same time, provide a climate under which learning is facilitated. The desirable features of such a program include the following:

- The training is administered near the normal work location.
- Most of the units of training are designed to be completed in increments of one to two hours.
- Steps are taken to minimize outside interruptions such as telephone calls and administrative tasks.
- The training is scheduled as a regular part of the supervisors' tasks.

Four: Efforts should be made to increase the rewards associated with successful learning.

Training is rewarding when the benefits -- to include recognition and greater opportunities for increased responsibilities and increased salaries -- are obvious. The implications for training officers are significant:

- Training must be relevant to the decisions and tasks being undertaken.
- Because the decisions and tasks are different at each level of management, the details of the subject matter should be different at each level.
- Supervisors should not be required to take training that has no bearing on what they do or will be expected to do in the near future.
- Training should become a permanent and integral element of the total personnel management process, especially as it relates to selection, placement and promotion.

In effect, the rewards associated with successful learning should begin with the training itself. They should be intrinsic.

Five: Efforts should be made to reduce the apprehensions associated with past learning experiences.

The most common apprehensions are those related to public schools: teachers, textbooks, tests and grades. To reduce such apprehensions, it is necessary to adopt instructional practices that are new to the persons being trained. Some of the more effective practices include:

- Self-instructional forms of training which permit supervisors to study the materials without the aid of a teacher,
- Work simulation techniques that closely resemble the management processes and problems found in real work situations, and
- The use of loosely organized training groups in which supervisors can participate in an open exchange of ideas.

Training principles and ways of increasing training effectiveness: both are designed to help you get the most out of MANAGING HIGHWAY MAINTENANCE.

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